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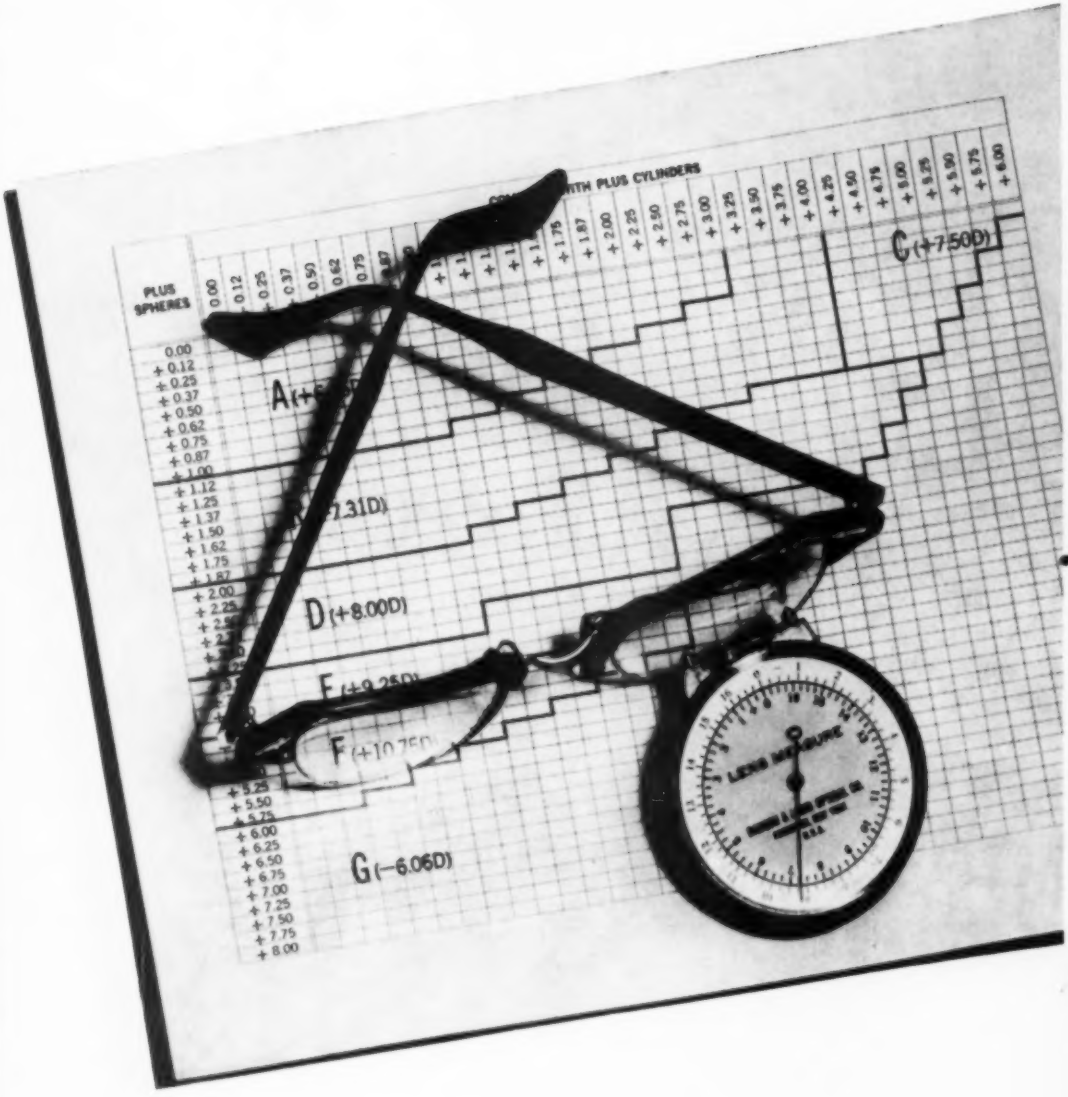

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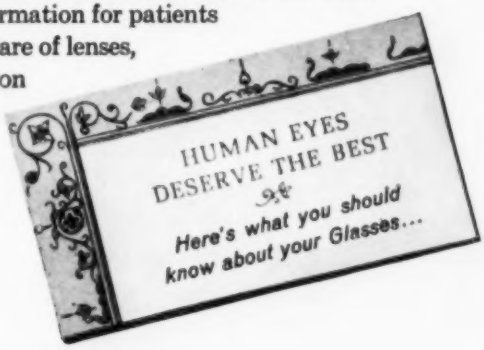

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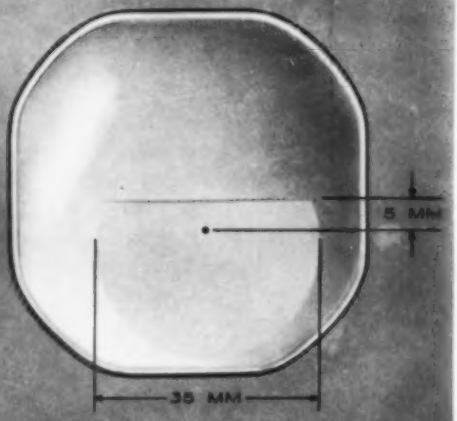

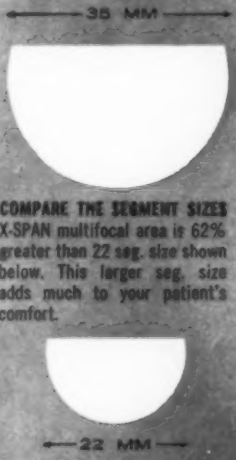

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Dr. Sheard was formerly editor of the *American Journal of Physiological Optics* and for many years director of the Department of Biophysics, The Mayo Foundation. The book contains 83 illustrations, 476 pages, $15.00.

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President, Shuron Optical Company

Practitioners often ask me and other Shuron people why our company doesn't maintain its own laboratories. Often rumors crop up to the effect that Shuron is opening a captive lab system, apparently started by those who feel that we should enter this part of the optical business.

The question comes up often enough so that I think it is important that we answer it for all . . . so there will be no mistaking our basic business philosophy.

First of all, Shuron has capital available through its parent company for such a venture. We have had, and I'm sure will have again, the opportunity either to purchase existing laboratories or to start new ones. So it is apparent that our reasons for not going into this business are not lack of money or opportunity.

The basic reason that we do not go into the laboratory business is that we feel the manufacturing function and the laboratory-distribution function operate best independently of each other. Only when they *are* independent do they offer the most in *service* and *product* to you.

If, for instance, Shuron were to serve this dual function, we would have conflicting interests within the same organization. Economics would dictate that we would have to be a manufacturer first, a lab-distributor second. Our thinking would be necessarily that of a manufacturer. Any laboratory-distribution network of ours would have conflicting functions, too. The laboratories would have to strive to serve you in the best possible way with a broad range of service and products. They would also have the conflicting responsibility of distributing the products of the manufacturing arm of the organization first—other products, second. The relative merits of the parent manufacturer's products could not be questioned by the captive laboratory. They would have to sell any and all products of the company with a partisan fervor.

We would certainly have to continue to sell to independent distributors. But we would be forced into the contradictory posi-

Report:

tion of being a supplier wanting to sell him products, and at the same time a competitor. Again a conflict: on one hand trying to serve the independent by selling him products; on the other hand, aggressively competing with him and taking business *away* from him.

We feel that, if we went into the captive laboratory operation, we would have too many compromises to make, that our contribution as a manufacturer would be reduced, that we would in effect simply be trying to sell direct.

Maybe you think you would prefer us to sell direct. Let's look at the advantages you have with the independent manufacturer-independent distributor system.

1—An independent laboratory distributor can offer you a broader product line and more comprehensive service. He can and does select products from many manufacturers, bring you the best that is available and those that are most suitable for you.

2—He screens products as they are introduced, and can counsel and detail you on the strengths and possible shortcomings of each product. He is not committed to support any one manufacturer. His sole interest is in serving you and helping you serve patients better.

3—One of the independent's functions is the stocking and inventory of product. A captive lab, to properly support its manufacturing arm, tries to sell you inventory, sometimes at special deals because its primary responsibility is to sell the products of the parent factory. A good independent supplier recognizes this inventory maintenance as his responsibility and serves you better because of it.

4—An independent distributor is *local*. He knows your problems because he's close to you, and, as a local business owner, he has the flexibility to meet your special needs. A captive lab is directed partially on a national basis and partially in a large regional system. Business practices are determined by executives who don't know you or your particular needs even if they do understand them.

5—We as a manufacturer can "keep sharp" by having to compete with other manufacturers in order to sell our product to the independent laboratory.

Unless your patients are pleased, you cannot exist in practice. Your independent distributor is your "silent partner," helping you to fulfill your responsibility. Only if that partner is devoted 100% to serving *your* needs can he be most effective. At Shuron, we will stand on our product advantages rather than a "captive" or direct selling system to market our goods. We want not to compete with your silent partner, because we would be injuring him. Our concern rather is to strengthen him, and so to strengthen you and the entire industry.

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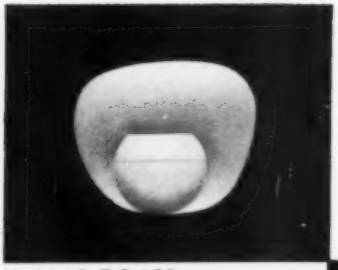

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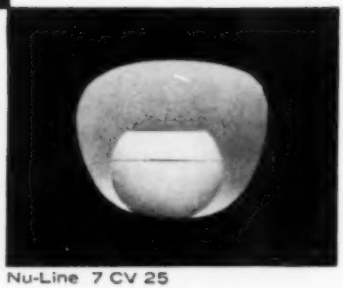

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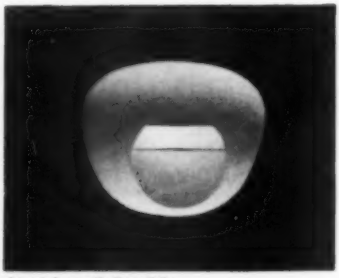

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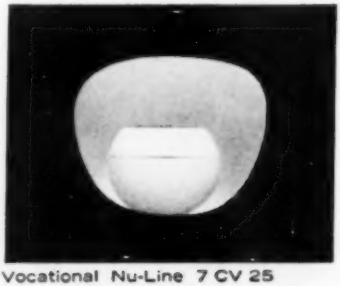

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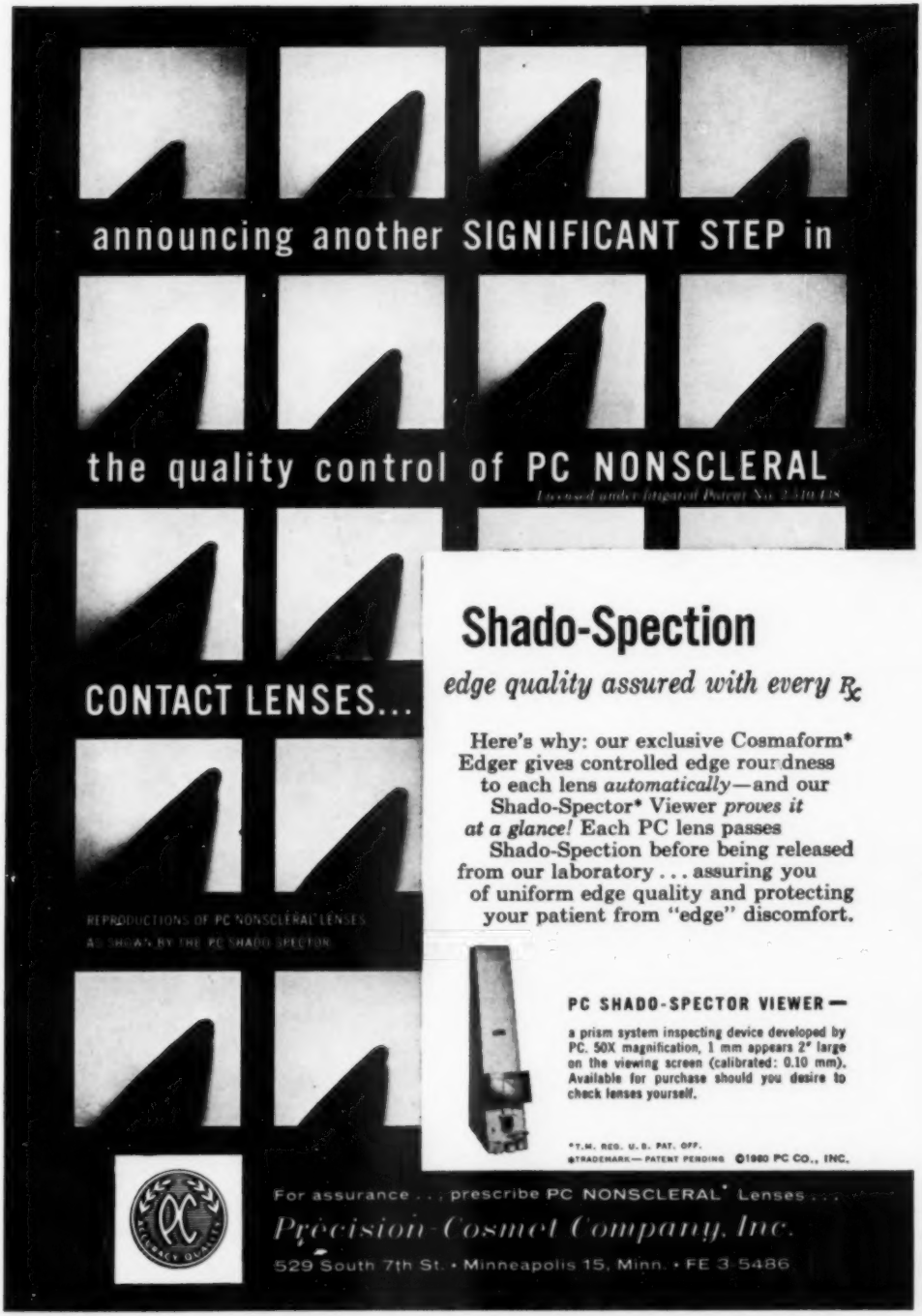
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Vol. 38 July, 1961 No. 7

LIMITED OCCLUSION AND HYPERPHORIA*

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School of Optometry, The Ohio State University
Columbus, Ohio
and
D. F. C. Loran‡
Manchester, England

The fusional movements of the eyes, as a general rule, produce an alignment of the eyes so that the images fall on corresponding points. Without these movements, either blurred vision or diplopia would occur. Also, on occasion, these effects are found even with the movements. Then the movements usually are inadequate to compensate for a phoria.

A patient with inadequate fusional movements experiences discomfort in the attempt to use simultaneously the two eyes in binocular vision. Of course, such discomfort can be avoided by the suppression of the vision from one eye and this commonly occurs in squint. If an individual, however, does not suppress the vision of one eye and does not have adequate fusional movements for binocular vision, he cannot use his eyes satisfactorily. It is not necessary to restate the expected signs and symptoms from this disorder; they have been presented in detail by many investigators. Suffice it to point out that the discomfort generally occurs in the circumstances in which the deficiency is most pronounced. For example, a vertical phoria may not be particularly troublesome in distance vision but in combination with a large lateral phoria at near may become overwhelming.

Anyone who routinely examines the eyes and determines patterns of binocular performance for patients, has an intuitive appreciation of the nature of fusional movements. This is a result of observation and experience. It is the sort of thing which prompts the remeasurement of phorias and ductions, a checking of the alignment of a refractor, or perhaps an occlusion test, if a binocular problem is suspected. At best, the basis of such suspicion often only is a nebulous cue supplied by the patient in the case history or perhaps one or more

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‡Optometrist, M.Sc. Formerly Fellow, English Speaking Union, Ohio State University.

tests in the examination. With these bases and only an empirical awareness of the nature of the fusional movements, it is not surprising that many problems of binocular vision fail to be recognized.

There have been a number of investigations to determine the precise characteristics of fusional movements under exacting experimental conditions. Accumulatively, these provide a rather complete expose of the nature of these movements and should be carefully studied by everyone engaged in refractive examinations. One aspect of fusional

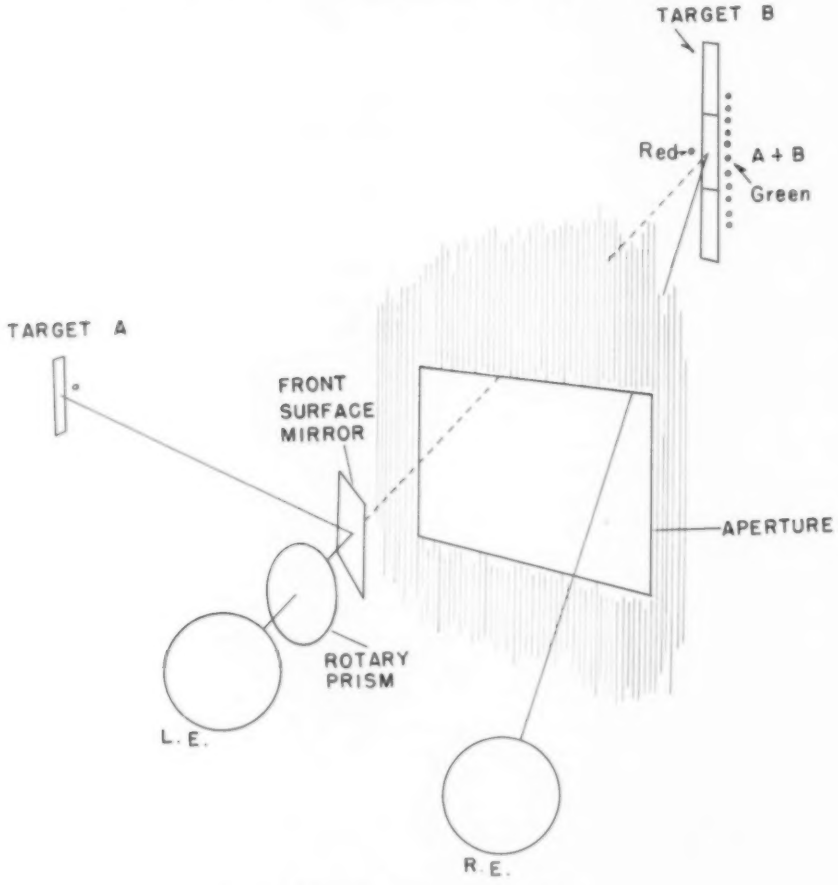

Fig. 1. Schematic sketch of the apparatus.

movements, i.e., residual tonicity following inducement, is established from the experimental point of view but has not been satisfactorily applied in practice. The chief cause of this discrepancy is the lack of a practical method to avoid the effect of residual tonicity and spurious innervations in the measurement of a phoria. This paper reports an investigation of a method to meet this need.

EXPERIMENTAL APPARATUS

The apparatus used in this investigation is essentially a modified vertical line test and chiefly consists of two components, the fusion targets and the measuring unit.

The fusion targets are two luminous streaks of light of equal width but unequal length (Figure 1). One target, A, is seen by the left eye only and is the shorter of the two fusion targets. The other target, B, is the longer of the two fusion targets and is seen only by the right eye. Also, it is adjustable and can be moved vertically or horizontally into any desired setting.

The luminance of the horizontal fusion targets, i.e., the vertical slits of equal width and unequal length, is approximately 210 c/m.^{2} So that the eyes would be free from fusional stimuli all stray reflections were eliminated by working in a laboratory free of windows and with all walls and equipment painted mat black.

The unit essentially consists of a front surface mirror and a rotary prism before the left eye. A head rest consisting of a chin rest, temple rests, and brow pads was integrated into the unit and fixed in position.

The front surface mirror was mounted on a black brass plate, and the size of the mirror was reduced to a narrow vertical rectangle 3.5 mm. by 70 mm.

Reducing the reflecting surface to these dimensions has the advantage of minimizing stray light. Also the small reflecting surface ensured that a correct and constant head position was maintained during repeated measurements.

The rotary prism provided a vertical prismatic power from 2.0Δ base-up to 2.0Δ base-down. The advantage of this small range is increased sensitivity. To increase further the accuracy of the readings a long pointer and a scale calibrated in 0.10Δ steps was mounted on the prism. With this arrangement, the scale could be read to 0.025Δ or 54 secs. of arc. The setting of the prism was made by a knurled knob and a metal extension 10 cm. in length was attached.

The fusion targets were located 2.5 meters from the centers of rotation of the eyes. In use the images of the two targets were fused

as shown in Figure 1. Since the target for the left eye was seen by reflection in the mirror, it was possible to alter the position of the mirror around a vertical axis to compensate for lateral imbalances. As a rule superimposition of the slits occurred and only in about one third of the cases was it necessary to adjust the mirror.

To facilitate the measurement of hyperphoria a series of small apertures 2.0 mm. in diameter were punched adjacent to the fusion targets. These are called measuring points. The points were located 15 mm. from the center of the fusion target and 2.5 cm. from each other. At a viewing distance of 2.5 meters this vertical separation represents one prism diopter deviation. The alignment of the zero position of the measuring points was determined with a telescope. It was mounted on a rigid stand and could be moved vertically to any desired setting; at any given setting it could be rotated only about a vertical axis.

For calibration of the instrument the axis of the telescope was adjusted vertically until the cross hairs coincided with the measuring point of target A; it was red in color for identification. The telescope was then clamped in this position. Next the telescope was rotated about a vertical axis so that the cross hairs were aligned with the measuring points of target B. The position of this target was then altered so that the midpoint of the scale, a green point, coincided with the center of the cross hairs. Thus the red and green points represent the zero positions for the measurement of hyperphoria.

EXPERIMENTAL PROCEDURE

Before each measurement the instrument was checked for alignment and calibration. The subject was seated at the instrument and asked to close his right eye and to observe target A and the red measuring point. He then was told to close the other eye and to observe target B and the green measuring point with the white points above and below it. The subject then observed the two fusion targets simultaneously. If two lines were reported the mirror was rotated about a vertical axis until the lines fused into one. If the rotation of mirror was not sufficient for fusion of the lines, target B could be moved laterally.

In order to avoid vertical fusional stimuli between measurements of hyperphoria, a cover test was employed for varying periods of times as advocated by Marlow.[12, 13, 14, 15] This procedure was used in the present investigation with the occlusion of the non-dominant eye. Dominance was determined by asking the subject to align a distant source of light through a circular aperture.

For occlusion Marlow usually substituted a ground glass for one of the patient's lenses. This type of occlusion is not satisfactory because light can enter the side of the lens and produce a stimulus to fusion. The same objection applies to a clip-on occluder. A more acceptable type fits tightly around the orbital margin and can be tied behind the head. Such an occluder prevents any light from entering the eye and can be worn with spectacles.

After each hyperphoria measurement the subject immediately replaced the patch while seated at the instrument, and before general illumination in the laboratory was provided. Thus every precaution was exercised to avoid unwanted fusional stimuli.

Readings were taken at 10-minute intervals for the first 30 minute following occlusion, and subsequent readings at 15 minute intervals. The time required for each set of readings averaged about 3 minutes.

Some of the difficulties encountered with the instruments were as follows:

(a) Several observers noted a minute vertical tremor of the measuring points. These were probably due to micronystagmus and were too small to interfere with readings. Oscillations of larger amplitude, i.e., up to 0.4Δ, however, did present a problem. They were reported in the main by subjects with erratic hyperphoria readings but were also found in one subject with dissociated vertical divergence. In all cases the subject was asked to set the red measuring point so that it appeared to move equally above and below the green measuring point. Up to 10 measurements were taken for each reading and only the mean value recorded.

(b) It was frequently reported that a movement of the measuring points occurred on blinking. The amplitude of these movements was approximately 0.2Δ or 7.2 minutes of arc and frequently was not equal for the two eyes.

(c) Several subjects reported the disappearance of one measuring point. This usually could be eliminated by closing and opening the eye with suppression while fixation was maintained with the other eye.

RESULTS

The variations in hyperphoria with occlusion were determined for 50 subjects. Repeatability of results was also studied.

A change in hyperphoria was considered significant if the hyperphoria changed by 0.5Δ following occlusion. It was considered regular if the change of hyperphoria per interval of time was constant. However, in all cases slight irregularities were present.

In keeping with conventional nomenclature, plus indicates right hyperphoria and minus indicates left hyperphoria.

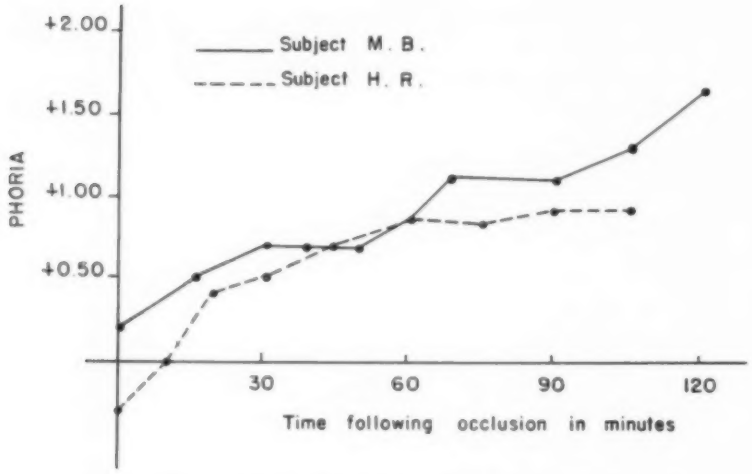

Fig. 2. Typical results showing linear increase in right hyperphoria following occlusion.

The results conveniently can be divided into four groups: in the first group a steady rate of change of hyperphoria was found: this occurred in 22 subjects (44 per cent). If slight irregularities are ignored the change was approximately linear for varying periods of time from 40 to 135 minutes following occlusion. After these periods little change was noted. Examples of this type of change are shown in Figure 2.

The second group includes subjects with a rapid initial change in hyperphoria following occlusion: this occurred in 15 (30 per cent) of the subjects. The change occurred in varying periods of time from 25 to 75 minutes following occlusion. Following these periods there was little change in the hyperphoria. These changes were approximately logarithmic in nature and representative examples are given in Figure 3.

In the third group no change occurred with occlusion, i.e., all measurements were within 0.2Δ of the initial measurement. This type of result was found for nine subjects.

The fourth group included all subjects with irregular and erratic changes in hyperphoria. Four such subjects (8 per cent) were observed.

As mentioned earlier repeatability of data for each subject was determined whenever possible. Most individuals indicated a high repeatability and consistency of data.

For a small number of subjects the repeatability was very poor: fortunately, such results did not occur in more than 10 per cent of all those tested.

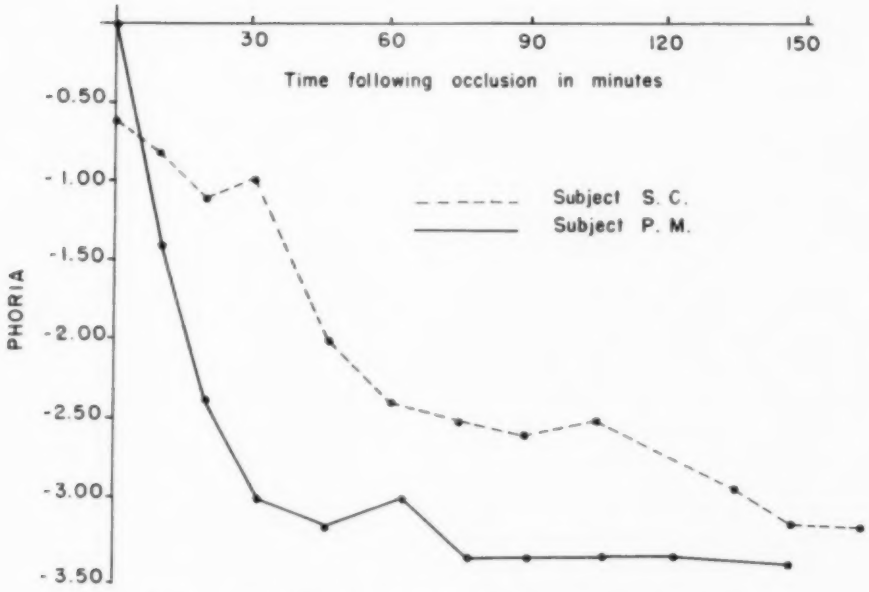

Fig. 3. Rapid initial increase in left hyperphoria following occlusion.

An average rate of change of hyperphoria for the experimental data is given in Figure 4. This trend was obtained by the method of least squares and is a second degree parabola of the form:

$$p = a + bt + ct^2 \qquad (1)$$

where p is the change of hyperphoria in prism diopters, t is the time

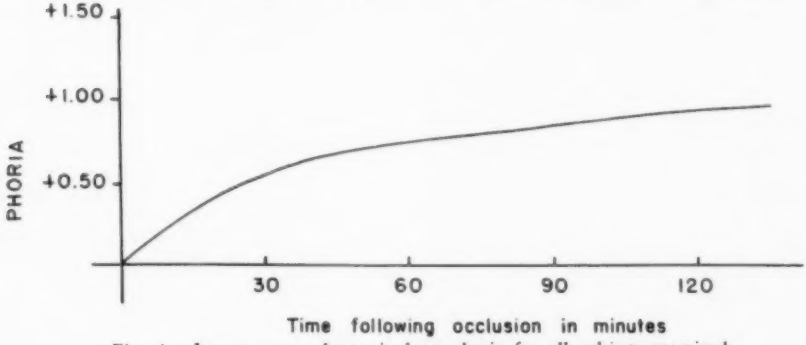

Fig. 4. Average mean change in hyperphoria for all subjects examined.

following occlusion in hours, and a, b and c are constants. The rate of change of hyperphoria following occlusion therefore is given by

$$dp/dt = b + 2ct \quad (2)$$

Solving for constants a, b and c in equation (1) it is found that

$$p = 0.28 + 0.62t - 0.15t^2 \quad (3)$$

Thus the average rate of change of hyperphoria for all subjects is

$$dp/dt = 0.62 - 0.30t \quad (4)$$

If the rate of disappearance of residual tonicity is designated dz/dt then

$$dz/dt = 0.62 - 0.30t \quad (5)$$

It should be noted that these relationships are valid only for periods of two hours occlusion.

CONCLUSIONS

A method was described for measurement of hyperphoria with the elimination of all unwanted stimuli to fusion. By this method significant changes are manifest in shorter periods of time than found by previous investigators.

Seventy-four per cent of subjects in this study followed a prediction from the findings of Hofmann and Bielschowsky[11] and Ellerbrock[9, 10] namely that the tonicity from fusional movements does not disappear immediately following occlusion and the residual tonicity markedly can affect measurement of a hyperphoria. Twenty-six per cent of the subjects did not follow these predictions. These subjects gave erratic results or manifested no change.

Marlow[12-15] and Charnwood[7, 8] concluded that a change in hyperphoria could not be demonstrated immediately following occlusion: they found a varying latent period for a change in hyperphoria to become manifest. This period was approximately 24 hours. The fact that neither investigator found early changes in hyperphoria probably was due to inadequate occlusion and the use of the Maddox Rod for the measurement of hyperphoria.

Abraham,[2] Beisbarth[4] and others claimed that the change in hyperphoria with occlusion is due to Bell's phenomenon. The results of this investigation do not substantiate this claim: there is little or no correlation between occlusion of an eye and the change of hyperphoria. This was demonstrated by findings with one subject. First the right eye was occluded and then the left eye. In a third investigation the eyes were alternately occluded: i.e., the initial hyperphoria was measured and the right eye was occluded. After a period of time the hyperphoria again was measured and then the left eye occluded. This procedure was repeated until the findings showed no further change. In

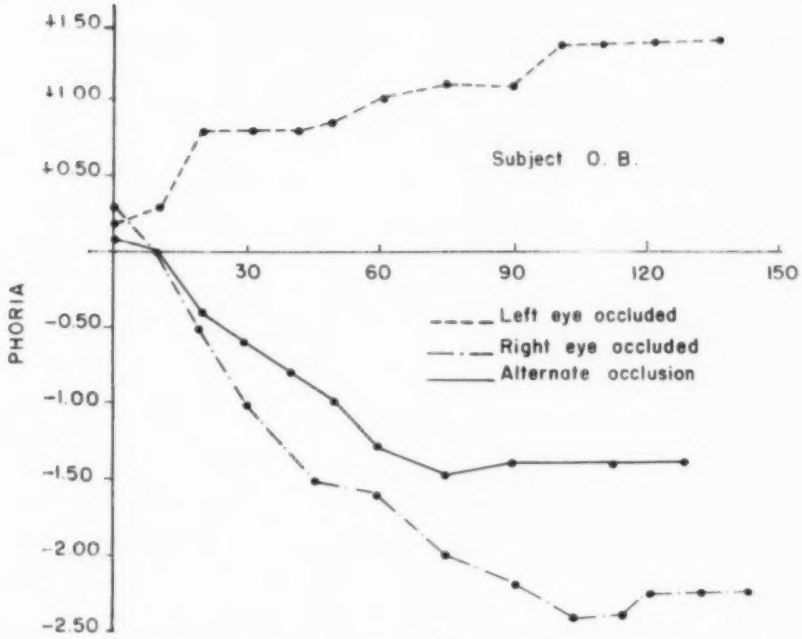

Fig. 5. Variation of hyperphoria with alternate occlusion.

all cases the results were the same: these results prove that the eye under cover does not invariably deviate upward.

Bielschowsky also reported that in many individuals the occluded eye deviated upward. This condition is a form of dissociated vertical divergence and is known as alternating hyperphoria.[1, 5, 6] In the present investigation, one subject manifested an alternating hyperphoria. An initial right hyperphoria of $+0.20\Delta$ increased to $+1.2\Delta$ hyperphoria following occlusion of the left eye for 90 minutes. Following occlusion of the right eye for two hours the hyperphoria was -2.40Δ. In a third investigation alternate occlusion was performed and the final measurement was -1.4Δ. It is interesting to note that the covered eye deviated downward; these data are illustrated in Figure 5. In view of these findings both alternating hyperphoria and hypophoria are varieties of dissociated vertical divergence.

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ORTHOPTIC TREATMENT OF STRABISMUS*

A STUDY OF ONE HUNDRED FORTY NINE NON-OPERATED, UNSELECTED, CONCOMITANT STRABISMUS PATIENTS COMPLETING ORTHOPTIC TRAINING AT THE OPTOMETRIC CENTER OF NEW YORK.

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INTRODUCTION

Orthoptics, the non-surgical method of strabismus therapy, has long been recognized as both a specific remedy in itself, for selected types of strabismus,[1-10] and an important adjunct to other methods of squint treatment (e.g., refraction and surgery).[11-17]

Much has been written on specific orthoptic techniques for altering the binocular neuromuscular mechanism,[18-23] and the ophthalmic literature abounds with complete case reports of orthoptically cured strabismics.[24-30]

The great controversy yet remaining in the field of orthoptics centers about the question, "How good a general strabismus remedy is orthoptics (together with refraction) in curing large numbers of unselected, concomitant strabismics?" This study is an attempt to begin to answer that question.

A review by the author of twenty-five years of the American and British optometric and ophthalmological literature has uncovered fifteen references to the relative success of orthoptics in binocularly rehabilitating large numbers of strabismics. The references are presented in the chronological order of their publication, accompanied by brief remarks about each:

1. Cantonnet and Filliozat[3] (1932) in the introduction of their classic volume on the orthoptic rehabilitation of strabismus, estimate that 70 per cent of all strabismics can be re-educated, usually in a period of from six to fifteen months.
2. Hicks and Hosford[31] (1935) after nine months of training with 32 patients, three to thirteen years of age, resulting in 5 cures (16%), felt that orthoptics was of little value except in conjunction with surgery.
3. Feldman[9] (1935) cites results of 87 cases after one year's work. Cures, or almost cures were obtained for 25 patients (29%), 25 showed little improvement or were dropped by the clinic, and 37 dropped out of their own accord.
4. Guibor[32] (1936) states that in his experience, refraction, atropine, and

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The Optometric Center of New York is a non-profit, tax exempt institution, chartered by the Board of Regents of the University of the State of New York. It was founded in 1956 to continue the clinical, research, and post-graduate educational work in vision, of the Department of Optometry, Columbia University, in the City of New York.

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occlusion cure 30 per cent of strabismics. Adding fusion training raises the rate of cure to 50 per cent.

5. Post[33] (1936) feels that orthoptic training adds an additional 20 to 30 per cent to the good results obtainable merely by suitable spectacles.

6. Law[34] (1938), deprecating the work of the "orthoptic department presided over by a medically unqualified certified orthoptist" at the Paddington Green Hospital, states that of 91 patients seen, 30 were cured with spectacles alone; 27 (30%) patients were cured by orthoptics, occlusion, and spectacles; and the rest could not be cured.

7. Burri[35] (1940) reports on two samples of strabismus patients trained at once weekly sessions, with no homework assigned. The results in the first group of 115 patients were: 25 cures (22%), 40 improved with orthoptics, one was cured with spectacles, and 59 patients could not be helped orthoptically. The second sample showing better results had a total of 64 patients: 20 were orthoptic cures (31%), 22 improved with orthoptics alone, and 22 were orthoptic failures.

8. Nugent[36] (1940), referring to 43 orthoptic cures out of 81 patients trained, concludes that "about 50% of all cases of strabismus can be cured with refraction, occlusion, atropine and orthoptics."

9. Smith[28] (1943) commenting on Nugent's paper, agrees with the efficacy of orthoptics as a specific, sole remedy, but, on the basis of his clinical experience, thinks that a 70 per cent figure is closer to the rate of cure. In 1950[6] he raised his estimate and stated that at least 75 per cent of non-paralytic strabismus can be corrected entirely by orthoptic treatment and spectacles.

10. Gillan[37] (1945), describing his orthoptic work with 63 children, five to twelve years of age, treated for periods ranging from one month to sixteen months, finds 23 (37%) orthoptic cures, 25 almost straight (five degrees or less residual deviation) and 15 failures. Optimistic about his orthoptic results, he states that deviations of twenty-five degrees or less may be treated orthoptically with success.

11. Giles[5] (1949) reports on two studies. One by Hogg shows 82 per cent success in a strictly selected sample of 50 patients, taken from an analysis of 116 orthoptic records. Gray and Hallmark show 92.7 per cent success in another sample of 41 five to fourteen year olds, again strictly selected as to prognosis, from a larger group of 82 records.

12. da Luz[38] (1949) reports the results of 63 patients completing training, out of an original sample of 143. By orthoptic training alone, 21 (33%) were straightened, 12 were given good binocular vision with training and surgery, and the remaining 30 did not result in straight fusing eyes with a combination of training, refraction, and/or surgery.

13. Castanera[39] (1951), reporting on 160 patients between the ages of three and ten years, found that 52 (33%) were cured with orthoptic treatment alone, 85 recovered normal binocular perception with training and surgery, and 23 were classed as failures.

14. Douglas[40] (1952), after a review of the literature and a denunciation of the work thus far published to support the efficacy of orthoptics as either a specific, or ancillary procedure in the treatment of strabismus, studies the results of two hospital orthoptic departments. On the basis of 203 patients, he deduces that only 42 (22%) were helped by orthoptic treatment. His conclusion is that an orthoptics department "can be profitably used for diagnosis, supervision of occlusion, and to maintain a closer liaison with the patient and his parents," all secondary to surgical treatment.

15. Jonkers[41] (1954) reports on his results obtained on 91 strabismic patients. Orthoptic therapy alone brought 31 (35%) to a functional cure, 23 were functional cures with orthoptic training and surgery combined, and 37 were not cured.

In perspective, the papers on the efficacy of orthoptics as a squint cure just reviewed, all have one or more of five basic faults. The present study has attempted to avoid all five. They are:

A. Orthoptics was viewed as a secondary method of cure, to be used after surgery had *not* given the desired results. As a consequence, orthoptic and surgical results were reported so intertwined, that it was

impossible to judge accurately the part played by orthoptics in the final results.

B. No satisfactory specific and detailed definition of "cure" or results was formulated, so that there could be no general agreement as to the results obtained in a specific case.

C. The training work unfortunately was performed largely, in the words of Law,[34] by "medically unqualified certified orthoptists," who, quoting Douglas,[40] "it must be remembered, have had only a minimum of scientific training."

D. Some of the quoted figures for rates of cure, were rough estimates based on the recollection of the clinical experience of that author, and not based on a strict analysis or study.

E. In several of the papers, too strict a selection policy in reporting cases has obscured the true value of orthoptics alone as a specific strabismus remedy for large numbers of strabismics.

One of the chief difficulties of the previous papers mentioned has been the lack of agreement on specific criteria for evaluating success in treating strabismus, and the classification of the results obtained in each case. A study at the University of California Optometry School, by Flom[42] (1958), has set forth five categories of results in some detail. His classification was found to be satisfactory, with the single exception that no requirement for satisfactory binocular motility in all positions of gaze, was stated for the class of "functional cure." With this single addition, the present study will utilize Flom's criteria as hereafter quoted:

> The criteria for a "functional cure" of strabismus, as adopted at the beginning of the U.C. study, were as follows: Clear, comfortable, single binocular vision must be present at all distances up to the near point of convergence, which is normal itself; there must be stereopsis and normal ranges of motor fusion; an occasional turning of the eyes may occur (up to 1% of the time) providing diplopia is experienced whenever this happens; correction lenses and small amounts of prism (up to 5Δ) may be worn if necessary.
>
> A second set of criteria was adopted for the category of "almost cured." In this category a patient may lack stereopsis, may exhibit strabismus with diplopia up to 5% of the time, and may need larger amounts of prism to maintain comfortable binocular vision. In all other respects the patient must meet the criteria for "functional cure."
>
> Categories of "moderate improvement" and "slight improvement" were adopted for those patients for whom the main improvement was respectively, in more than one, or in only one, of the defects associated with the strabismus. The category of "no improvement" was adopted for those patients for whom there was no significant improvement in the strabismus or its associated defects.

ORTHOPTICS PROCEDURE AT THE OPTOMETRIC CENTER

Before entering upon the specifics of the present study, a general statement as to the procedure followed for orthoptic patients at the Optometric Center is in order.

1. Every strabismus patient undergoes an initial refraction, visual analysis, and orthoptic workup.

2. The information obtained from the workup and analysis is discussed with the patient and/or parent, and a prognosis is given, as well as an estimate of the approximate length of time required for the desired results to be obtained.

3. The usual frequency of visit is twice weekly for three-quarters of an hour periods. Group sessions are conducted with three or four patients being seen simultaneously. Different optometrists attend the patient on each of the two training days. In addition, up to one half hour daily home sessions are prescribed (other than occlusion, which may be constant for as long as two week periods).

4. The staff holds monthly seminars to discuss the patients under current treatment.

5. Before dismissal, the patient is sent back for refraction and final analysis. After terminating regular clinic training, the patient is followed up at bimonthly recheck visits for at least one year, to ascertain that the newly acquired binocular status is retained permanently and with comfort.

6. In the hope that others may wish to repeat our work, the types of therapy used at the Optometric Center have been broken down (for the purposes of simplification) into six classifications, each group being accompanied by the instrumentation used to carry out that particular classification of therapy.

A. HAND EYE COORDINATION
   1. Cheiroscope (both stereoscope and Maddox types)
   2. Rotoscope with pointers
   3. Telebinocular with pointers (BU and AN series)
   4. Brock posture box
   5. Stereofly
   6. Pigeon-Cantonnet stereoscope
   7. Brock glass and light
   8. Seizel Fusor
   9. String pushouts and pushups
   10. Basic Stereomotivator, near viewer and pointer

B. ACCOMMODATIVE-CONVERGENCE TRAINING
   1. Prism reader
   2. Tele-binocular with tromboning
   3. Teleye-trainer with accommodative rock
   4. Binocular rock "flipper"
   5. Omnitrainer
   6. Stereo-Disparator
   7. Rotoscope with auxiliary lenses
   8. Troposcope with auxiliary lenses

C. MOTILITY TRAINING
   1. Arneson Squint Korrector
   2. Rotoscope
   3. Saccadic board
   4. Calisthenic series

5. Pursuit movements
6. Myoculator
7. Kratoculator

D. OCCLUSION
1. Part-time total occlusion
2. Total elasto-plast occlusion
3. Binasal or bitemporal occluder
4. Frosted glass over the better eye
5. Colored lens over the amblyopic eye
6. Stippled nail polish on the patient's lens

E. PRESCRIPTION
1. Distance Correction only
   A. Undercorrection
   B. Overcorrection
   C. Exact correction
   D. With vertical and/or horizontal prism
   E. For constant or intermittent wear
2. Near Correction only
   A. Undercorrection
   B. Overcorrection
   C. Exact correction
   D. With vertical and/or horizontal prism
3. Bifocal Prescription
   A. For constant wear
   B. With vertical and/or horizontal prism

F. FUSION
A. Space
1. B.S.M. intermediate and near viewers
2. Arneson Squint Korrector
3. Remy Separator
4. Set of loose square prisms
5. Brock Anaglyph Wall Rings
6. Dynascope
7. Bielschowsky after-image test
8. Brock after-image transfer test
9. Brock posture box
10. Red-Green glasses and light or T.V. screen
11. String vergence
12. Topper polaroid set
13. Straw and tube
14. Phorometer
15. Kratoculator and red-green glasses
16. Mirror training
17. Bar reading
18. Myoculator and red-green glasses
19. Physiological diplopia training

B. Instrument
1. Troposcope
2. Rotoscope
3. Omnitrainer
4. Stereo Disparator
5. Kratometer
6. Stereoscope
7. Prism reader
8. Teleye-trainer
9. Diploscope
10. Cheiroscope
11. Telebinocular

CRITERIA OF CASE SELECTION FOR THE STUDY

A total of 517 patients were seen by the orthoptic department

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   B. Overcorrection
   C. Exact correction
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   B. With vertical and/or horizontal prism

F. FUSION
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11. String vergence
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3. Omnitrainer
4. Stereo Disparator
5. Kratometer
6. Stereoscope
7. Prism reader
8. Teleye-trainer
9. Diploscope
10. Cheiroscope
11. Telebinocular

CRITERIA OF CASE SELECTION FOR THE STUDY

A total of 517 patients were seen by the orthoptic department

during the four years June, 1956, to June, 1960. Of these, 284 had strabismus, the others having non-squint binocular asthenopic and reading problems. In order to guage the value of orthoptics as a remedial measure in the correction of squint, the following criteria for inclusion of a patient in the study were formulated:

1. The patient had strabismus, i.e., manifested a binocular deviation, either constant, intermittent, or periodic.
2. The deviation was not capable of correction with lenses.
3. No surgical intervention had previously taken place.
4. There was no evidence of paresis or paralysis in the primary or any secondary position of gaze.
5. The patient attended at least eight sessions of orthoptic training (one month).
6. The patient terminated regular clinical training. If the patient satisfied the above six criteria, he was included in the study, with no prior knowledge of results.

149 patients met the criteria and were included in the study.

135 were not included for the following reasons: (1) 19 were post-surgical cases with residual angles, undergoing training to fully correct the squint. (2) Eight had non-comitant squints with either paresis or paralysis of one or more of the extra-ocular muscles. (3) Nine were accommodative esotropias which were fully corrected with spectacles and several training sessions. (4) 48 dropped out of training in seven or fewer visits (twenty-one dropped out after the first workup visit). (5) 51 were still undergoing training.

TABULATION OF THE CASES

The total sample of 149 cases were tabulated under twenty-six items considered by the author to be of major importance in classifying and categorizing the squint, and toward judging the final results obtained in each case:*

1. Case number.
2. Sex of each patient, included to see if a sex difference exists in the training results obtained, or in the types of squint encountered.
3. Date of the start of training, recorded in terms of month and year. This item was included to judge whether the quality of results improved over the four-year period.
4. Age of the patient at the start of training, to the nearest half-year.
5. Length of time the patient has had the squint condition, to the nearest half year. This was an estimate by the parent or patient and was corroborated occasionally by photographs.
6. Variety of squint fixation in two categories: alternating and unilateral. Unilateral recorded in terms of the deviating eye R or L.
7. Direction of deviation in four categories: Exo, Eso, Hyper-exo, and Hyper-

*The complete tabulation is on file at the Optometric Center of New York.

eso. To be considered a hyper case the vertical component must have measured two prism diopters or more.

8. Frequency of appearance of the deviation in three categories: Constant, Intermittent (occasionally straight), and Periodic (occurring either only upon near fixation X^N or only at distance fixation X^D.

9. Presence of an accommodative component. That is, whether the necessary refractive correction helped to reduce the strabismic deviation at distance.

10. The magnitude of the squint deviation, measured in prism diopters. Determined with fixation at twenty feet, while the patient was wearing the distance correction, by the amount of loose prism necessary to neutralize the movement on the alternate cover test. The amount was tabulated in one of three groups: 0 to 15Δ, 16 to 30Δ, 31 to 60Δ.

11. Five tests of binocular correspondence were used throughout the four-year period of the study. Several additional tests have been utilized recently, but have not been included in this study. The five tests routinely used are listed below. The results of the tests were recorded as: N meaning normal correspondence, S meaning suppression of the image of one eye, A meaning absence of binocular correspondence, and a blank indicating that the test was not performed or could not be interpreted by the patient.

A. Troposcope: Lack of fusion at the objective angle, measured while the patient was wearing the distance correction, by neutralizing the eye fixation movement on alternate flash, was held to indicate lack of normal binocular correspondence.

B. Diplopia: Vertical dissociation of as much as 20Δ in some cases, with or without red-green glasses, was used to elicit diplopia. If the direction and amount of diplopia did not agree with the angle as determined on the cover test, measured at the same fixation distance, a lack of normal correspondence was said to exist.

C. Red-green glasses: The patient views a muscle light at six to ten feet and the type and amount of diplopia elicited are noted. Any discrepancy between the prism neutralized angle, objectively determined, and the subjective separation (beyond a 5Δ error of measurement) was held to indicate some A.R.C. under the test conditions. If the results were questionable, the angle of squint was neutralized with loose prism, and the subjective impression of the patient was again noted. More than the 5Δ error of measurement equivalent separation of the red and green lights was considered as A.R.C.

D. The Hering or Bielschowsky after-image test[42]. At six feet, the subject, wearing distance correction, is exposed monocularly to a brilliantly illuminated filament one foot in length, placed horizontally for one eye, and vertically for the other. The patient is instructed to fixate a central target on the filament in both instances. The patient then reports the configuration of the after-images of the streak filaments, with the eyes open and then closed respectively. In both instances, for normal correspondence to be said to exist, the subjective impression should be a perfect cross.

E. Brock String test: This test is for binocular correspondence at the near point. A string four feet long is fastened at one end, and is held along the midline firmly at the bridge of the nose. A fixation light is held at or within the centration point or range respectively. The test was performed without red-green glasses unless deep suppression was evidenced at the near point. Answers indicating absence of correspondence were: a single string down the midline, appearing a mixture of red and green, with the fixation light split into red and green halves; or the "inverted Y" where the string between the nose and the fixation light is seen single (A.R.C.) but splits behind the fixation light (N.R.C.), thus forming the "Y."

12. Best corrected visual acuity at distance. The acuity was measured monocularly with a projecto-chart at twenty feet. The score was recorded as (−) if more than one letter on the lowest line attempted was missed.

13. Number of training visits attended, excluding original refraction and final evaluation session.

14. Rate of visit: Either once or twice weekly.

15. Attendance: Rated in three categories. Good, for an average of eight visits per month if twice weekly, or eight visits in two months if one visit per week was called for. Fair, for a six or seven visit average. Poor, for less than a six visit average.

16. Motivation of the parent: A subjective rating by the author in each case, in four divisions: Good, Fair, Poor, and Never Came (−).

17. Motivation of the patient: A rating by the author, based on the attitude of the patient toward the training, and the opinion of the staff clinician. Graded in three categories, Good, Fair, and Poor.

18. Does assigned home training. A rating from 1 to 5 (from poor to good) based on the child's account of the homework done between visits, and the staff optometrist's impression. No home assignments were given to three patients.

19. Therapy: Already previously covered under instrumentation. Under each classification of therapy, the recording was made as follows: Blank if not used at all. X if done moderately. XX if the main type of therapy given.

20. Resultant deviation: Tabulated as a percentage of the time that a turning is noticed by the parent, child, and the staff optometrist. Divided into three categories: 1% or less (functional cure), 5% (almost cured), more than 5% (failure).

21. Clear binocular vision: Either yes or no based on the acuity measurement, in addition to the patient's estimate.

22. Comfortable binocular vision: Based on the patient's estimate, X = yes, Blank = no.

23. Near point of convergence: Taken with a flashlight or ophthalmoscope light as a fixation target. Listed in inches as the examiner's estimate from the corneal plane. Normal considered as 4".

24. Stereopsis: Recorded as X meaning presence of and blank indicating absence. Considered in two categories: (A) Macular: Tested for on one or all of: Telebinocular DB6 Visual Skills Card or Keystone Airplane Series. Rotoscope stereo targets 14 to 20. Omnitrainer, AN Series transparencies. (B) Peripheral: Basic Stereo Motivator with intermediate screen, and rabbit and rings anaglyph series. Brock Wall Rings.

25. Range of motor fusion: The range in prism diopters using a peri-macular flat fusion target with sufficient detail to act as a check on accommodative effort: e.g. pumpkin, F and L, G O D, ball and arrows on the Rotoscope. On the Troposcope the cowboy, clown and dog, and tiger targets were used. Normal range was considered 8BI to 20BO or greater.

26. Tabulation of the results according to Flom's five categories previously defined: 1. Functional cure, 2. Almost cured, 3. Moderate improvement, 4. Slight improvement, 5. No improvement.

ANALYSIS OF THE SAMPLE BEFORE TRAINING

Total cases	149
Sex	68 male, 81 female
Wearing spectacles after initial refraction	111
Extent to which spectacles were worn:	
1. Constantly, single vision	61
2. Constantly, bifocals	20
3. Distance only	19
4. Near only	11
Direction of deviation:	
1. 54 eso	
2. 58 exo	
3. 17 hyper-eso	
4. 20 hyper-exo	
Variety of squint fixation:	
1. Unilateral	69
2. Alternating	80
Size of the deviation:	
1. Range:	
Smallest	9Δ eso = 4Δ hyper
Largest	60Δ eso
Hyper range	2Δ to 22Δ
2. Distribution:	
0 to 15Δ	55
16 to 30Δ	79
31 to 60Δ	15
Frequency of squint:	
1. Constant	80

2. Intermittent 50
3. Periodic 19

Absence of binocular correspondence:
1. On at least one test 39
2. On three or more tests 26
3. On the after-image test 26

Age at the start of training:
Distribution:
1. 5 to 10 years 82
2. 11 to 15 years 50
3. 16 to 30 years 11
4. 31 to 44 years 6

Angle of squint altered by correction:
A. Decreased by correction:
1. Exo 18
2. Eso 54
B. Increased by spectacles:
1. Exo 12
2. Eso 7
C. No change 20

Amblyopia:
A. Acuity gradient. Brock[44] (Ratio of the acuity of the better eye/acuity of the poorer eye)
Ratio greater than 2 in 16 cases
B. Range in acuity of amblyopic eyes at the beginning of training:
20/40– to 20/300
C. Corrected V.A. poorer than 20/40 in one or both eyes in 29 cases.

ANALYSIS OF RESULTS OF TRAINING FROM AUTHOR'S TABULATION

I. *Overall Results of Training According to Flom Criteria*

	Funct. Cure	Almost Cure	Mod. Imp.	Slight Imp.	No Imp.
Patients	49	60	22	10	8
Per Cent	33%	40%	14%	7%	6%

Overall Results vs. Number of Cases and Per Cent of Cases

The patients shown in the "functional cure" group always had straight eyes, many showing no movement on either the alternating or monocular cover tests, at final dismissal from the regular clinic sessions. The others showed a small movement which was followed by instantaneous recovery. Performance of a complete refraction on each before dismissal revealed no indication of the previous manifest binocular deviation.

In the "almost cured" category, the patients' eyes were straight all the time under ordinary conditions, but tended to deviate when the patient was unusually fatigued, ill with fever, or under strong emotional stress; not more than 5 per cent of the time, and always with diplopia.

Combining the "functional" and "almost" cured groups, and adding four patients whose eyes are straight (Cases Nos. 25, 26, 47, and 146), but are listed as "moderately improved" because of the technical requirements of the "cured" categories (2 subnormal ranges

of motor fusion, 1 with a 7" N.P.C. rather than the required 4", and 1 with frequent asthenopia, headaches, and accommodative spasm), we may state that a total of 113 (76%) of the patients in the sample had binocular vision with straight eyes 95% of the time or more at dismissal from the regular clinic training sessions. The other 36 patients had residual deviations occurring more often than 5% of the time, and were classified as orthoptic failures. Of these, 8 of the "moderate improvement" group dropped out when quite near the "almost cured" category, i.e., with their eyes straight well over half the time, and possessing all of the technical factors necessary for a cure with several months of additional stabilization work.

This result was obtained under the following relatively poor clinical conditions: 1. Group therapy was conducted, with the patient receiving a limited amount of individual care. 2. Patients were seen by different clinicians with different personalities and philosophies of training. 3. Control and management of each case was relatively poor. The absence of these unfavorable factors in other types of training situations should yield even better results on a similar sample of strabismic patients.

II. *Patients Finishing Training Without Need for Spectacles*

Funct. Cure	Almost Cure	Mod. Imp.	Slight Imp.	No Imp.
13	14	4	4	4

No Need For Rx vs. Training Results

It is interesting to note that 27 (24%) of those in the "cured" columns, having straight eyes 95% of the time or better, did not require spectacles either to improve vision or to help adjust the accommodative-convergence neuromuscular mechanism to a normal condition.

III. *Number of Training Visits Made*

VISITS:

	Funct. Cure	Almost Cure	Mod. Imp.	Slight Imp.	No Imp.
Exo:					
Average	23	23	28	16	12
Range	11-57	10-76	11-66	9-24	12
Eso:					
Average	32	32	30	45	24
Range	15-70	11-68	11-59	9-71	10-33

Visits Made vs. Training Results for Exos and Esos

The exotropes required fewer average visits for each category of results and the range can be noted to have a substantial spread for each category and for both exos and esos.

IV. *Size of the Angle of Deviation of the Squint*

	Funct. Cure	Almost Cure	Mod. Imp.	Slight Imp.	No Imp.
0-15Δ:					
Exo	15	13	5	0	0
Eso	5	13	4	0	0

16-30Δ:					
Exo	18	16	4	2	1
Eso	10	16	5	4	3
31-60Δ:					
Exo	1	1	2	0	0
Eso	0	1	2	4	4

Size of Deviation vs. Results

The size of the angle shows a very high inverse relationship with the quality of results obtained. It is one of the most important factors in prognosis, only 3 of 15 cases (20%), where the angle was greater than 30Δ were in the "cured" categories. The consensus of the orthoptic literature is that the angle of deviation is very important in effecting a cure. Giles[5] states: "The number of visits required was proportional to the angle of squint." To see if Giles' contention was borne out by our data, the following table of size of angle against the number of visits was made for the *successful* cases only.

	Size of the Squint Angle		
	0-15Δ	16-30Δ	31-60Δ
9-20 visits	22	26	0
21-40 visits	19	24	2
41-70 visits	2	14	1

Size of the Deviation vs. Visits for the "Cured" Cases.

The table shows that there is a trend in the successful cases toward more visits for the higher angles of deviation.

V. *Age at the Start of Training*

	Funct. Cure	Almost Cure	Mod. Imp.	Slight Imp.	No Imp.
5-10 years	26	31	10	6	8
11-15 years	20	20	7	3	0
16-30 years	4	3	3	1	0
31-44 years	0	6	0	0	0

Age at the Start vs. Results of Training

In the youngest group, the incorrect neuromuscular habits of strabismus were not of long standing, but motivation and attention span were poorest, so that at the pre-school and early school ages most of the "functional cures" were recorded, and also most of the failures. If the child's motivation and interest could be stimulated, the results were generally good. Of the adults who were motivated to undertake training, straight eyes were the result in all nine patients over twenty-one years of age. Absolute "functional cures" by Flom's definition were not obtained in these adults, since either: stereopsis could not be elicited, or residual deviation with diplopia, occurred up to 5 per cent of the time, but all could be classed as "almost cured."

VI. *Age of Onset of the Strabismus*

Age of Onset*	Funct. Cure	Almost Cure	Mod. Imp.	Slight Imp.	No Imp.
0-1 yr.	4	7	6	5	0
1-2	8	7	4	1	4
2-3	2	9	2	2	0
3-4	5	6	1	0	1
4-5	9	7	2	0	1

(VI. Continued from preceding page)

5-6	5	3	0	1	0
6-7	2	2	1	0	0
7-8	2	0	2	0	0
8 over	7	7	0	0	0

*Unknown in 23 cases

Age of Onset vs. Results of Training

The age of onset is claimed by almost every writer on strabismus to be the most important determinant in achieving a cure. According to the results in the present study, a relationship is apparent. All of the onsets after eight years of age are to be found in the "cured" categories. Onset before one year of age did not preclude a "cure," providing the angle was small and training was commenced at an early age. Eleven cures (50%) and eleven failures were obtained for onsets below one year of age. Of those cases with onset under three years of age, 37 of 61 (61%) were "cured," and for those patients with onset later than three years, 56 of 65 (86%) are to be found in the two "cured" classifications. In twenty-three instances the patient or parent could not state when the eye first turned. The danger of drawing conclusions from information which is not verifiable in most cases, is only too apparent.

VII. *Sex Differences in Training Results*

	Funct. Cure	Almost Cure	Mod. Imp.	Slight Imp.	No Imp.
Male	19	27	11	7	5
Female	30	35	10	3	3

Sex of Patient vs. Results of Training

A small sex difference was found in favor of the girls, most probably due to the intractability and shorter attention span of the younger boys, coupled with the greater motivation of the girls to remove the cosmetic stigma of an ocular deviation.

VIII. *Patients Dropping Out Before Completion*

	Funct. Cure	Almost Cure	Mod. Imp.	Slight Imp.	No Imp.
Cases	0	20	9	4	1

Training Results vs. Dropouts

Those patients attending eight or more sessions, but dropping out before final dismissal were mostly in the "almost cure" and "moderate improvement" groups. These patients dropped out after two to four months of work, when the good results of the training were becoming apparent; the deviating eye being straight almost all of the time, and the patient having voluntary control over the deviation. The usual reasons for dropping out was inconvenience, long travel time (up to two hours each way in some cases), and school schedule changes.

IX. *Direction of Deviation*

	Funct. Cure	Almost Cure	Mod. Imp.	Slight Imp.	No Imp.
Eso	10	21	11	6	6
Exo	27	22	7	2	0
Hyper-eso	4	10	0	2	1
Hyper-exo	8	7	4	0	1

Results vs. Direction of Deviation

A higher percentage of exotropes (82%) finished in the "cured" categories, and fewer failures were sustained, than for the eso group, (64%) "cure," both with and without a vertical component. The weight of evidence in the literature is non-committal on whether better results are obtained in training convergent or divergent deviations, there being almost an even division of opinion in the twenty-odd references expressing an opinion, reviewed by the author.

X. *Regularity or Frequency of Turn*

	Funct. Cure	Almost Cure	Mod. Imp.	Slight Imp.	No Imp.
Constant:					
Exo	6	8	3	2	1
Eso	7	26	12	8	7
Intermit.:					
Exo	20	15	6	—	—
Eso	5	3	1	—	—
Periodic:					
Exo	10	7	—	—	—
Eso	1	1	—	—	—

Training Results vs. Regularity of Turn

As might be expected, more intermittent (96%), and periodic (100%), squints resulted in straight eyes, than in the constant strabismics (59%). The exotropias again show a higher rate of "cure" than for the esos in all three groups.

XI. *Variety of Squint Fixation*

	Funct. Cure	Almost Cure	Mod. Imp.	Slight Imp.	No Imp.
Unilateral Exo	12	14	3	0	0
Unilateral Eso	7	17	6	4	5
Alternating Exo	21	15	6	2	1
Alternating Eso	9	14	7	4	2

Variety of Squint Fixation vs. Training Results

The consensus in the literature reviewed is that unilateral squints are easier to train and with better results than the alternating squints. In our study, there is not a significant difference (only 1%) between the totals in the "cured" categories for the alternators 74% (59 of 80), and 73% (50 of 69) for the unilateral. The exotropes again show a higher rate of "functional cures" and "almost cures" for both the alternating and unilateral strabismics.

XII. *Anomalous Correspondence*

A lack of binocular correspondence manifested on three or more

tests was the factor most closely related with failure: 85% (22 of 26) of these did not finish training in a "cured" category. The detection of lack of binocular correspondence in an eso case is much more ominous than in an exo. Only 23% of the esotropes with an anomalous response on even one test (6 of 26) were "cured" while 62% (8 of 13) exos responding anomalously to one or more tests ended training within a "cured" category. All 8 of those in the "no improvement" column, and 9 of 10 in the "slight improvement" column gave A.R.C. responses on two or more tests.

	Funct. Cure	Almost Cure	Mod. Imp.	Slight Imp.	No Imp.
Lack of Correspondence:					
One Test	5	3	1	0	0
Two Tests	2	1	0	1	0
Three Tests	0	1	2	3	2
Four Tests	1	2	3	5	5
Five Tests	0	0	1	0	1

Training Results vs. Anomalous Correspondence

The After-Image Test alone indicated the future failure in 77% (20 of 26) of those responding to it anomalously.

	Funct. Cure	Almost Cure	Mod. Imp.	Slight Imp.	No Imp.
Cases	3	3	5	8	7

Anomalous After-Image Response vs. Training Results

XIII. *Attendance, Motivation and Homework*

	Funct. Cure		Almost Cure		Mod. Imp.		Slight Imp.		No Imp.	
Attendance:	c	d	c	d	c	d	c	d	c	d
Good	35	0	19	9	5	2	5	2	2	0
Fair	14	0	19	8	6	5	1	2	6	0
Poor	0	0	3	3	1	2	1	0	0	0

where c means completing training and d means dropouts

Training Results vs. Attendance

	Funct. Cure	Almost Cure	Mod. Imp.	Slight Imp.	No Imp.
Motivation of Parent:					
Good	45	38	14	8	4
Fair	3	6	3	0	0
Poor	0	1	1	1	0
Adults and older children, no parent came	4	15	3	1	4

Training Results vs. Parent Motivation

	Funct. Cure	Almost Cure	Mod. Imp.	Slight Imp.	No Imp.
Motivation of the Child:					
Good	38	22	11	1	0
Fair	11	36	7	6	7
Poor	0	2	3	4	1

Motivation of the Child vs. Results

	Funct. Cure	Almost Cure	Mod. Imp.	Slight Imp.	No Imp.
Does Home Exercises*:					
1 (poor)	0	0	0	2	2
2	1	4	4	2	1
3	5	30	5	2	2

4		39	19	9	3	2
5	(good)	5	6	3	1	0

*Exercises not given in 3 cases

Results vs. Diligence in Home Assignments

As is true in any learning situation; e.g., school, musical instrument, sports, etc., the regularity of attendance, motivation and diligence in practice or homework are important factors in determining the final results. In the case of orthoptic exercises, apparently, on the basis of the tables from this study, attendance, motivation, and proper effort in performing assigned home work are sufficient but not necessary factors in obtaining good results. Thus, those patients with poor attendance, poor motivation, etc., never resulted in a "functional cure," although good attendance, etc., did not necessarily result in a "cure," the other factors (I to XIII) previously mentioned weighing heavily in the final result. See Figure I.

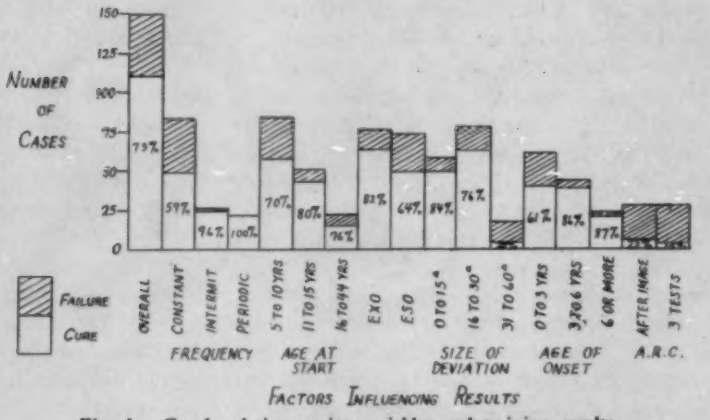

Fig. 1. Graph relating squint variables and training results.

CONCLUSIONS

1. The results of the study indicate that orthoptics including occlusion and in conjunction with refraction, yields results on a large number of unselected strabismics, in which the eyes are straight cosmetically, and binocularly functional 95% of the time or better in 76% of our sample (73% according to the Flom criteria), at dismissal from regular clinic training. These results were obtained under clinical conditions which were not optimal; (group therapy, poor control, different practitioners, etc.) and better results should be obtained where these unfavorable factors do not enter.

2. Orthoptic results are better in a highly motivated patient,

(and parent), who attends training sessions regularly, with a squint: of angle less than thirty prism diopters, of late onset (after three years), of short duration, which occurs intermittently or periodically, is divergent (exo) in direction, and where binocular correspondence is present.

3. The prospects of failure are greatest where a squint of large angle, is constant, of early onset, is lacking binocular correspondence, and the motivation of the parent and patient is less than optimal: which in turn leads to poor attendance and a sluggish effort in clinic and on assigned home exercises.

4. Those results in this study which correlate strongly with the consensus of the literature are: size of the angle of deviation (four to one odds against curing a case with an angle larger than 30Δ), the effect of anomalous correspondence (four to one odds against cure of a case with A.R.C. on three or more tests), and the regularity of turn (59% rate of cure for constant turn, and 98% average rate for intermittent and periodic turns). Our results which disagree strongly with the orthoptic literature are: Alternating vs. monocular (74% to 73% "cures" respectively) whereas the literature strongly favors better results for the unilaterals; age of onset (50% "cures" for onset under one year, and 61% "cure" for those onsets under three years, whereas the literature finds the cure of early onsets almost impossible; and, age at the start of training (76% "cures" over the age of 16 years), the majority of other writers feeling that results are good only at the very early ages. The factor with the greatest lack of agreement within the literature, (opinion being about evenly divided), is the expected results with respect to direction of deviation of the squint. Our results show 82% "cure" for exotropes vs. 64% for the esotropes.

5. The Flom criteria provide a handy vehicle for defining the final results in a strabismus case, and the five categories of results nicely evaluated the final outcome for the most part. Only the disposition of the four patients with "moderate improvement," whose eyes were straight and binocular 95% of the time or better, but who failed one or more of the technical requirements for either of the "cured" categories is questionable.

6. A surprising 24% of the patients in the "cured" categories did not require the use of spectacles upon dismissal.

FUTURE RESEARCH

1. It was shown in the present study that orthoptics as a therapeutic measure in strabismus, can help three out of four concomitant, previously untreated, unselected (as to prognosis) strabismic patients. It has not shown the long term effects of this training on the binocular

neuro-muscular mechanism. A study is therefore called for, to re-analyze the 113 patients dismissed with straight eyes (95% of the time or better) in three years, to see if the binocular rehabilitation is a lasting one. Such a study is planned by the author.

2. A detailed and comprehensive analysis of the factors responsible for the orthoptic failure in 36 of the 149 strabismics is called for. This study is already underway.

3. Because it may be claimed by those such as Law[34] and Douglas,[41] that the strabismus would have cured itself anyway in many of the "cured" strabismics in this study, and that the orthoptic effort contributed little to the final results, a large scale controlled study is called for. Two groups of strabismus cases, non-paretic and non-operated, with an equal distribution of age of onset, sex, age, size of angle of squint, presence of binocular correspondence, and direction of deviation, in the two groups should be assembled. The control group should have only refractive care on a regular yearly basis for five years. The experimental group is to have complete refractive and orthoptic care for the same period of time. The results are then to be tabulated and statistically analyzed for the actual contribution of the orthoptic training on the strabismus.

4. Because of the very poor results obtained on esotropic patients with anomalous correspondence in this study, and as reported throughout the world, further research should be organized to help understand and work out better treatment routines for this very difficult binocular problem.

5. Since samples of strabismics vary in composition, this present study should be repeated by other workers, with a larger unselected sample of strabismus cases if possible, to validate the present study.

6. Because excellent results can be obtained with pre-schoolers who can be motivated; more attention must be devoted to motivating techniques, specialized instrumentation, and methods of increasing rapport and attention span in these very young squinters.

7. Because other methods of general squint therapy are utilized, a study comparing the rate of functional cure obtained by refraction alone, by surgery alone, and by orthoptics alone, would certainly seem to be in order. The author is planning such a study.

SUMMARY

1. A twenty-five year review of the orthoptic literature was made and fifteen pertinent reports on the efficacy of orthoptics as a strabismus remedy were cited and discussed. Five general objections were raised to these papers.

2. Flom's criteria and classification of results of strabismus therapy were quoted and utilized in the present study.

3. The orthoptic procedures at the Optometric Center were discussed, and the instrumentation listed for six classifications of therapy.

4. Criteria for inclusion in the study were enumerated, with 149 patients meeting the criteria.

5. The 149 cases were tabulated under twenty-six items, which categorized and classified the strabismus. The twenty-six categories were listed and briefly discussed.

6. The sample of 149 cases was analyzed before training, according to twelve pertinent factors.

7. The results were portrayed in tables and one graph: discussed, compared, and analyzed.

8. Conclusions were drawn from the study, on the efficacy of orthoptics as a remedial measure in strabismus, at dismissal from regular clinic training sessions. On a sample such as ours, the odds are three to one in favor of an expected cure.

9. Suggestions for further research called for by the results of the present study were listed and discussed.

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ANNOUNCEMENT

SPECIAL FRAME FOR CATAREX LOAN SERVICE .

In order to service requests from laboratories, dispensers and professional men for a sturdy round-eye frame with cable temples to be used with Catarex temporary lenses, The Vision-Ease Corporation plans to offer a 1/10th 12-karat gold-filled frame meeting these specifications, according to Robert E. Conn, Jr., Vision-Ease Sales VP.

The new product, called "Catarex Temporary Frame," features a strong bridge, precision-beveled eyewires, adjustable rocking pads and comfort cable temples. It has no ornamentation other than a modest reverse bevel on outside surfaces to break the otherwise plain appearance of the gold-filled. Eye sizes range from 40 mm. through 46 mm., bridges from 20 mm. through 24 mm. Available cable temples range from 5¼" through 7" (L.O.) in quarter-inch graduations. The new Catarex frame will be available for delivery from Vision-Ease stocks on August 1, said Mr. Conn.

CORNEAL CONTOURS IN THE GENERAL POPULATION AS REVEALED BY THE PHOTOKERATOSCOPE*

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Bausch & Lomb Incorporated
Rochester, New York

INTRODUCTION

It seems rather strange that no one since Gullstrand[1] has reported quantitative data concerning corneal contours. Changes in corneal contours as a function of age present a very interesting study in growth and aging processes. The effect of intraocular pressure, injury and other factors on corneal curvature certainly belong as one of the important aspects of ocular image formation and hence refraction. It is not surprising that the advent of contact lenses has brought a more active interest in this field.

The problems of growth and aging, and the problems of fitting contact lenses represent the stimuli to the present study. Thus far a good deal of effort has been spent in developing a rapid, accurate technique of obtaining data. Preliminary data on 67 adult eyes are presented here.

In order to describe the corneal contours completely, the following may be included:

(1) A description of the contour, i.e., ellipsoid, paraboloid, etc.
(2) If the cornea has an axis of symmetry, the relationship between this axis and the line of sight and the pupillary axis, and
(3) The position of the vertex of the surface with respect to the limbal opening.

In 1846 Senff reported measurements made on three meridians of two eyes. From these measurements he calculated the ellipticity of the cornea. His data are reproduced in Helmholtz.[2a] Senff also measured the angle between the major axis of the ellipse and the axis of the eye. (One can not be sure what he means by the "axis of the eye." Helmholtz assumed that he meant the visual axis.) The vertex of the ellipse is described as lying below and outward with respect to the (visual) axis of the eye.

Helmholtz's[2b] measurements on three female eyes resulted in exactly the same type of findings of those of Senff. He described these corneas

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as approximately resembling prolate ellipsoids (an ellipsoid generated by revolving a plane ellipse about its major axis). He further stated that the center of the corneal surface coincides almost exactly with the vertex of the ellipse.

In the second edition of Physiological Optics, Helmholtz cites the data of Aubert and Mattheissen.[3] These investigators had made measurements which showed that the central position of the cornea was spherical and that only 16° away from the axis did the surface become ellipsoidal.

Gullstrand concluded from his own photographic data and from those of contemporaries that "the form of the normal cornea can be described by saying that there is a central optical zone where the curvature is approximately spherical, and which extends horizontally about 4 mm., and somewhat less than this vertically, and is decentered outwards and usually also a little downwards; and that the peripheral parts are considerably flattened, decidedly more so on the nasal side than on the temporal, and usually more so upwards than downwards."[1] The decentration of the optical zone is given in terms of the point where the line of sight pierces the cornea—his ophthalmometric axial point. He further states that in normal eyes the pupil is decentered in the same manner and hence the optical zone "can be considered as approximately centered with respect to the pupil."

Bier's description[4] agrees with this except for his confusion concerning the point of reference of the eccentric position of the central optical zone and his so-called negative zone. Evershed-Martin[5] has recently called into question the existence of the negative zone. Careful examination of photographs of eighty-four eyes taken with the present instrument and one described earlier[6] has failed to reveal the existence of such a negative zone.

Perhaps our knowledge at this point can be summed up as follows: The normal adult cornea consists of a central spherical or toroidal zone (optical zone) centered on the pupillary axis, surrounded by a more or less asymmetric annular zone flatter than the spherical zone. The center of the optical zone is located at the geometrical center of the limbal opening. It is approximately four millimeters in diameter.

APPARATUS

Since a large number of corneas were to be examined, a method which would combine as much data as possible in a single data gathering period was sought. Photokeratoscopy offers an excellent technique for such quantitative procedures. Although the method seems simple enough at first thought, difficulties seem to compound as one starts to

take photographs and attempts to analyze them. Several of the problems to overcome are:

1. Obtaining the desired data from as few photographs as possible, ideally one photograph,
2. Obtaining photographs of the reflected image sharply in focus over the area covered, and
3. Obtaining photographs which are not blurred by eye movements.

Gullstrand used a plane object surface in his photokeratoscope. Such an instrument provides in a given photograph, information over a limited portion of the cornea. By taking a number of photographs along a given meridian, the contour along that meridian can be calculated. Photokeratoscopes using hemispherical and cylindrical object surfaces have been described.[6] The authors did not, however, report data concerning the corneal contour. Using a hemispherical or cylindrical object surface provides a fairly satisfactory answer to the first two problems listed above. By moving the outer portions of the object surface toward the eye, a larger area of the corneal surface can be depicted in a single photograph and the reflected image surface is flattened out, providing a surface which when photographed will be in sharp focus from edge to edge. If one has enough light, a small stop can be used. In order to satisfy problem number three, a short exposure will be required—still more light.

The instrument used to obtain the present data made use of a cylindrical object surface and a high intensity flash tube to meet the requirements set forth above.

The new photokeratoscope can be seen in Figure 1. It will be noted that the object surface is made up of eleven aluminum rings of varying width and spacing. Ten of the rings lie on the surface of a cylinder having an inside diameter of 5 inches. The eleventh ring lies in the base of the cylinder. In the corneal photographs it is the smallest reflected ring surrounding the camera lens. Four wedge-shaped strips are attached to the inner surface of the rings. These are reflected as radiating lines. The rings and strips are painted flat black on three surfaces. The inner surfaces are finished clear to reflect the light from the flash tube. The rings and strips can be seen clearly in a front view of the instrument shown in Figure 2. In this figure can also be seen the flash tube surrounding the camera lens. When the subject is in the proper position, no light from the flash tube strikes his cornea directly. The only light that arrives at the cornea is that which is directed toward the inner surfaces of the rings and from there reflected onto the cornea.

The photographs are taken at unit magnification at an effective stop of f/16. There is enough light at this opening to give good color photographs.

It is an easy matter to calibrate such an instrument by the use of precision steel balls. The photographs of the reflected pattern were magnified 10 times and the spacing of the rings recorded as a function of the ball radius. The spacing of the rings was designed so that in the reflected image the rings would be spaced uniformly. In the original design this design criterion was met very closely. In examining a photograph of a cornea, the pattern can be interpreted in exactly the same manner as a contour map. If the reflected rings are perfectly circular and uniformly spaced, we know that we have a perfectly spherical cornea. If the rings are elliptical we know then we have a toric cornea. If the spacing of the rings increases as the ring diameter becomes larger, we know we are dealing with a cornea which flattens toward the periphery.

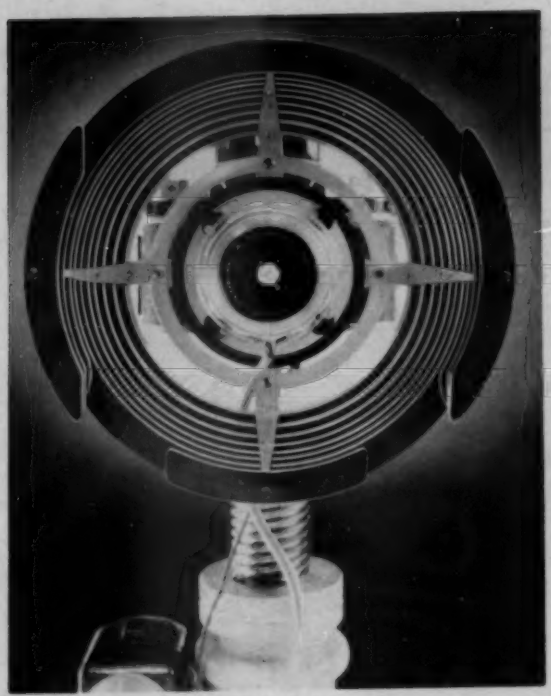

Fig. 2. Patient's View of Photokeratoscope. Note the cut outs for forehead, nose and lips. The flash tube may be seen surrounding the camera lens. Four focusing lights are mounted behind the flash tube.

Because of the interference of the nose and the overhanging brows, it is virtually impossible to get a photograph which will cover the entire area of the cornea. However, except for the above exceptions, the corneal area can be covered from limbus to limbus. It must be kept in mind that in all photokeratoscopic pictures one is looking at the reflected image from the tear layer surface and not the corneal epithelium. Variations due to an irregular tear layer can, of course, be checked by taking repetitive photographs. However, certain features of the cornea will be hidden by the tear layer. One of the most important of these is the limbal area since the tear layer will form a meniscus in the angle formed by the sclera and the cornea.

RESULTS

Photographs of sixty-seven eyes have been examined and classified. Measurements were taken representing the radius of curvature of the

Fig. 3. Type A Cornea. This example shows a cornea very nearly a perfect sphere.

central zone of the cornea 2 mm. in diameter. Zone 1 readings were made on either side of the center, representing a zone having a 4½ mm. diameter and zone 2 readings were taken representing a zone having an 8½ mm. diameter. The width of these zones is about one millimeter. Due to some inherent inaccuracies, and approximations, the measurements are accurate to within about ±0.2 mm.

The subjects used in this study were employees of the Engineering Division of Bausch & Lomb Incorporated, ranging in age between 22 and 62 years of age.

Each cornea is an entity unto itself. In order to describe each cornea distinctively would require a very extensive analysis of each photograph.

Fig. 4. Type B Cornea. Note the very excessive flattening at the nasal limbus.

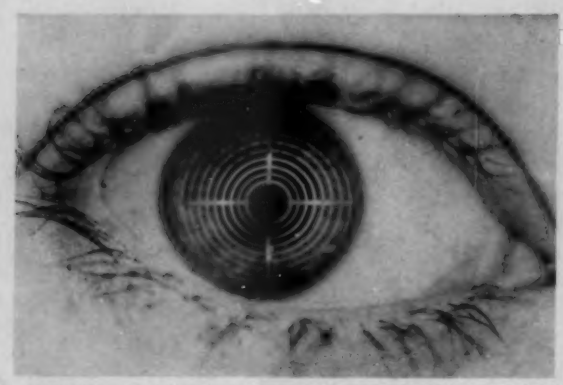

Fig. 5. Type C Cornea. The sharp increase in slope near the nasal limbus represents a sudden convexity seen in a number of the eyes examined.

For purposes of reporting the results at this time, measurements were made along the horizontal meridian only and an attempt has been made to group the 67 corneas measured into four types. The typing is dependent upon whether the first zone measurements are symmetrical to within less than 0.2 mm. or asymmetrical by 0.2 mm. or more.

A further breakdown is in terms of the amount of flattening in the peripheral zone relative to the central zone. A type A cornea is one in which zone 1 is symmetrical and zone 2 the flattening is less than 2.0 mm. for either of the two readings at this zone. Type B cornea is one in which zone 1 readings are symmetrical and the flattening in the zone 2 readings is 2.0 mm. or more. Type C cornea is one in which the

Fig. 6. Type D Cornea. Note the very pronounced asymmetry.

zone 1 readings are asymmetrical and the zone 2 flattening is less than 2.0 mm., and the type D cornea is one in which the zone 1 readings are asymmetrical and the zone 2 readings are 2.0 mm. or more flatter than the central reading. Examples are illustrated in Figures 3-6. It should be kept in mind that the center here refers to the point at which the line of sight pierces the cornea. This point will be some small distance away from the apex of the cornea but not to any large extent since the angle lambda is something of the order of one and one-half degrees.[7]

Without any exceptions, the zone 2 reading on the nasal side was always flatter than the other four readings. At the zone 2 reading one is still some distance from the limbus and in numerous corneas there is very excessive flattening between the zone 2 reading and the limbus. This is rarely true on the temporal side. Another feature that is noted in some of the corneas is that just before one reaches the limbus there is a rather abrupt convexity. This little shelf at the limbus can be observed in subjects with the unaided eye and is easily seen with the slit lamp. This can be seen on the nasal side of the eye illustrated in Figure 5.

The mean readings for each zone in each corneas type are given in Table I. It will be noted that about sixty per cent of the corneas measured have symmetry at zone 1 and hence are classified as types A and B.

Mean Corneal Radii at five points at the horizontal meridian.

TABLE I

Type Cornea	No. of Eyes	Nasal		Central Zone	Temporal	
		Zone 2	Zone 1		Zone 1	Zone 2
A	19	9.0	8.2	7.7	8.2	8.6
B	22	11.6	8.3	7.8	8.3	9.0
C	11	9.2	8.6	7.7	8.1	8.3
D	15	12.0	8.9	7.9	8.3	8.8

The central zone is approximately 2.0 mm. in diameter.
The zones have a width of 1.0 mm.
Zone 1 has a central diameter of 4.5 mm.
Zone 2 has a central diameter of 8.5 mm.
The corneal types are described in the text.

The zone 1 radii are about one-half millimeter longer than the central zone radii. It is among the type B corneas where some of the most dramatic flattening takes place peripherally. This, of course, is not brought out by the mean value, but there are some eyes which flattened to 14 and 15 millimeter radii.

An interesting observation relates to the relationship between the central zones and the peripheral zones. Particularly in the B and D

corneas, one often sees a cornea which is centrally spherical and peripherally toric (with the rule). Often this toricity becomes quite pronounced very close to the limbus. Zone 2 symmetry along the horizontal meridian was noted in ten of the type A corneas. Asymmetry appears to be the rule—at least asymmetry about the line of sight. A study is now being undertaken to determine whether some sort of axis of symmetry does exist.

SUMMARY AND CONCLUSIONS

Sixty-seven eyes have been photographed using a photokeratoscope having a cylindrical object surface. The photographs have been analyzed in terms of radius changes along the horizontal meridian. Using asymmetry and degree of flattening as criteria, the sixty-seven corneas have been classified into four groups.

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A STATISTICAL STUDY OF CLINICAL SCORES OBTAINED IN THE WIRT STEREOPSIS TEST*

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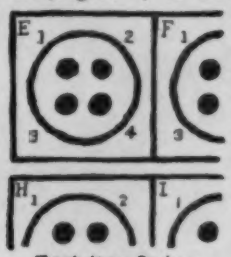
For several years this writer has routinely used the following stereoscopic test on all patients as a means of ascertaining in a general way the degree of binocular vision present. It was noted, however, that relatively few subjects achieved the "average" score as postulated by the instructions accompanying the test materials. As a practical clinical "expected" score was considered to be helpful in assessing a patient's stereoscopic skill the present study was made.

The test, called the Stereotest which was designed by S. Edgar Wirt, Ph.D., in 1947 consists of a Polaroid Vectograph test card which is used with Polaroid filters to produce separate pictures for each eye as in a stereoscope. The card is designed to be held at 16 inches and constitutes a test applicable to the evaluation of stereoscopic ability under the dynamic conditions of nearpoint seeing. The test items consist of a series of groups of four dots (Figure 1) enclosed within circles arranged



Test Item Designs
Fig. 1

in twelve graded steps of decreasing disparities (or greater difficulty) from top to bottom. These steps of disparity are in decimal fractions representing the reciprocal of the differences from 14.3 seconds of arc or 0.028 mm. separation to 16⅔ minutes of arc or 1.939 mm. separation. The figure 1.0 of stereo acuity as in item I represents the discrimination of details of a size subtending an angle of 20 seconds of arc

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†Optometrist. Fellow, American Academy of Optometry.

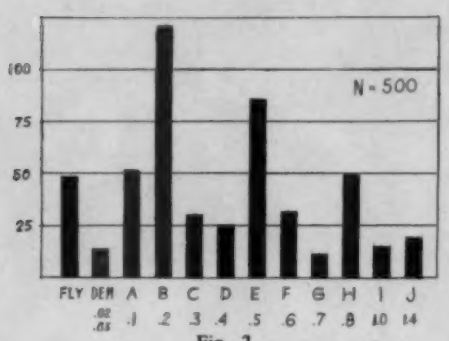

Fig. 2

which according to Wirt represents "approximately average stereopsis by this method of testing." The test as a whole is alleged adequately to classify average and below average levels of macular stereopsis. In addition to this card the one containing the Stereo Fly was also used which measures very gross stereoscopic ability and it has been included in the findings.

The procedure included a random sampling of 500 subjects from the case records in routine optometric practice. The tests were conducted in a typical clinical situation with average office illumination at the usual reading distance and with no special emphasis for high scores. Patients of presbyopic age were aided by the use of their nearpoint correction or supplementary plus spheres when necessary. Only those patients with binocular vision sufficient to discriminate the stereoscopic attributes of the Stereo Fly were included in the study.

As shown by the histogram, Figure 2, a bimodal distribution was found with a mean for the twelve graded scores of 0.39 expressed in terms of the Wirt percentage of stereopsis. This value which corresponds approximately to the score D on the card is materially less than the

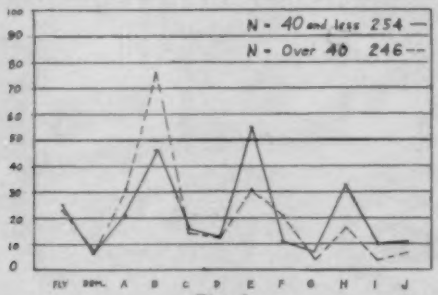

Fig. 3

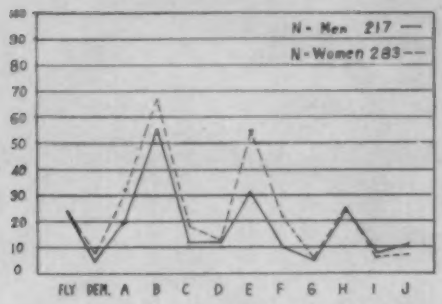

Fig. 4

score I or 1.0 which was asserted by Wirt to represent "the approximate average stereopsis" by this method.

For the purpose of determining whether or not there is any significant difference in achievement to be expected between presbyopic and pre-presbyopic patients a comparative graph was made for the scores of subjects aged 40 and younger and of those over 40. Here the bimodal distribution indicates significantly higher scores for pre-presbyopes who had a mean value of 0.45 as compared with a mean value of 0.35 for the older patients. This difference is equivalent to one step or score interval between the two groups. Figure 3.

As Figure 4 indicates, there was no significant difference between the scores of men and women. The mean difference was only 0.03.

In conclusion it may be said that the routine clinical scores for stereopsis in optometric patients may be expected to be somewhat lower than that postulated by the designer of the test with a mean score as expressed by the Wirt decimal scale of approximately one-half that assumed to represent average achievement. Pre-presbyopes scored higher than presbyopes with a difference of one score interval (10 percentage units) in the mean scores between the two groups. No significant difference was found between the sexes in this test.

It, therefore, may be assumed that the expected response from most patients undergoing this test would be from B to E with only the exceptional ones achieving the allegedly more "normal" but higher scores from G to J. Pre-presbyopes would be expected to do somewhat better than the general average, the presbyopes slightly less.

In the opinion of the writer Wirt has designed a very useful and practical test and the purpose of this investigation was not in any way to detract from this. It was merely to secure a more realistic criterion with which to evaluate the findings.

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SPECIAL REPORT

THE POPULAR ACCEPTANCE OF VISION CERTIFICATES*

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Optometrists today are faced with the necessity of informing their patients of the quality, extent, and function of their vision. Never before has the fashion appeal of frames been so strong, nor have contact lenses been so wearable for those who can wear them. While these trends have made the use of ophthalmic corrections more palatable for our patients, at the same time the role of spectacles in the overall picture of vision care has been over emphasized. Is it not time to ask the question, "What is the ultimate goal for an optometrist?"

It is refreshing to find in the *Vision Information Program* a medium for providing a meaningful interpretation of the results of an eye examination to patients. The Vision Certificate[1] provides the patient with a report of his visual acuity, motility, fusion, visual fields, and color vision. Additional information includes specific advice as to when the spectacles are to be worn and whether the acuity was determined with or without spectacles. While the Certificate carries the statement, "Void two years from date of issue," space for remarks is provided for individual instructions to a patient. Carbons of the Certificates are sent to the Vision Certificate Bureau where a file is kept for replacing lost certificates and for mailing to the patient a notification when the two year valid period has passed. Research reports on the vision status of the American people will be available when sufficient statistics are accumulated at the Certificate Bureau.

It is the purpose of this paper to determine the extent to which optometrists use the certificates, for what categories of patients, the patient acceptance of the program, to what purposes the certificates are used, and what effect the use of the certificate has on the control of the patient.

In July, 1960, Hofstetter polled those optometrists using the Vision Certificate and subsequently reported his findings in VIP-NOTES,[2]

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[1]Provided by the Vision Information Program, Inc., 427 Bankers Trust Bldg., Indianapolis 4, Indiana.

[2]Vol. I, No. 2, September, 1960.

a newsletter for members of V.I.P., Inc. More than a third of the certificate users from 19 states answered the questionnaire as follows:

Forty-two per cent (42%) stated that they issued the Certificate to "all patients." Another 14 per cent checked the same answer with minor qualifications, such as, "occasionally I forget when I am busy," "except very old people," "except tiny infants." In other words, well over half do issue the Certificates to virtually all patients.

Those who limited the issuance of Vision Certificates to specific categories checked the following groups:

88%—Employees of certain industries
87%—Patients requesting vision reports for specific purposes
81%—Persons applying for drivers' licenses
75%—Military personnel, government employees, and employees of other agencies requiring vision certificates
56%—School children
44%—Patients for whom new spectacles are not prescribed
6%—Patients referred for medical care (one respondent commented that this was the most gratifying use of the certificate!)
50%—Wrote in special categories not listed in the questionnaire.

The five "reasons" listed in the questionnaire showed the following *average* ranks:

1.97—"It provides tangible evidence of the thoroughness of my service" (40% gave this *first* place. None gave this last place.)
2.54—"Appreciation by the patient as a personal service." (37% gave this *second* place. 20% gave this first place. None gave this last place.)
2.90—"The 2-year notification." (31% gave this *third* place, 20% first place and 9% last place.)
3.31—"Added professional prestige for me." (31% gave this *fourth* place, 6% first place, 14% last place.)
4.27—"Saves me writing reports." (66% gave this *last* place. Only 3% gave this first place.)

The average additional time required per patient for using the Vision Certificate was found to be 5.3 minutes in this survey.

In October, 1960, 229 questionnaires were mailed to as many patients who were given Vision Certificates during the previous several weeks in the author's practice. 134 questionnaires were sent to female and 95 to male patients. 44% of the females and 44% of the males returned the questionnaires, and the percentage of response was ap-

proximately the same at all age levels. 31% of the respondents were in the 6 to 17 year age group; 30% were in the 18 to 40 year age group; and 39% were over 40 years of age.

95% of the females and 93% of the males *kept their certificates.*

81% of the females and 78% of the males *felt the certificate was useful.*

80% of the females and 78% of the males *would desire another certificate following the next examination.*

Opportunity was given for the patients to indicate for what purpose they had used the certificate. Many did not fill in this portion of the questionnaire, explaining that they had not had the certificate for a long enough time. However, 58% of the girls and 28% of the boys of school age had used the certificate at school.

Since so few of the adults had an opportunity to use the certificate because of the short length of time it was in their possession, several categories are merely listed to show the number of instances in which the certificates were used:

9 Physician
8 Drivers license examiner
4 Employer
3 Insurance personnel
1 Employment office.

Many expressed the expectation of having use for the certificate in the near future. One 11 year old boy thought the certificate was unnecessary since "You tell us this information." A seventy-five year old woman did not understand the certificate. A forty year old man who was green blind and had learned to "cover up" did not wish to have a certificate since it might get into the hands of his associates and hurt him in a business way. The only other respondent who gave a totally negative response, a 49 year old male, added the comment, "I like you anyway."

In the office the use of the certificate opened up many conversations about the eyes and their function so that the certificate became a useful public relations vehicle. Where defects were found, most patients were appreciative of the information and the explanation. This was particularly true of children and their parents.

The use of the certificate had a surprising effect in that it helped some patients to accept the diagnosis and suggested treatment. This was particularly true of nervous and highly suggestible patients. Perhaps the fact that an optometrist was willing to sign a certificate reporting his vision status, reassured the patient to the extent that he was more willing to cooperate.

In conclusion, the use of a vision certificate in optometric practice meets a need in helping patients to understand the results of their eye examination, to accept the diagnosis and treatment, and to keep a record of their vision status. The Vision Certificate plan studied in this paper has been well received by the optometrists using the plan and by the patients issued the Certificates.

304 MEDICAL ARTS BLDG.
RICHMOND, INDIANA

ANNOUNCEMENT

YOUNGER INTRODUCES FRAME-MARKING DEVICE

A new frame-marking device, called Younger Identiframe, is being marketed by Younger Manufacturing Company, the Los Angeles firm which makes the Younger Seamless Lens.

The instrument is a special optical version of the famous Dymo Tapewriter, used in business and industry to mark everything from files to machinery.

Identiframe is slightly larger than a pair of pliers, with a roll of special tape built in to the end of one handle. A revolving die can be set to the letter desired and a gentle squeeze on the handle simultaneously embosses the tape with a white raised letter and advances the tape for the next character. Frames may be marked with patient's name, phone number, Rx number and date, or any other combination of markings. The tape used is semi-permanent in its application; it can be removed and re-applied with ease, if necessary, and it is not affected by washing, oils, cosmetics or hair preparations.

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THE SECTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

An important part of the annual meeting of the American Academy of Optometry is devoted to the Sections. If the organization and work of these Sections were well understood by the Fellows, particularly the new Fellows, they would be better able to take advantage of the opportunities these activities offer. This is an attempt at such an explanation and is an invitation to all Fellows to participate in the Section or Sections of their interest.

There are five of these Sections each of which meet for three two-hour sessions during the four days of the Academy program. These are: Section on Refractive Problems and Aniseikonia, Section on Contact Lenses and Subnormal Vision Aids, Section on Public Health and Occupational Vision, Section on Binocular Vision and Perception, and Section on Pathology. Each Section functions under the control of a

Committee appointed by the President and Executive Council of the Academy. The principal function of the Committees is to arrange for the Section meetings. Recently the chairmen of the Sections have been made members of the Home Study Course Committee with the expectation that out of each specialized area may come such courses.

The Sections are unique in that they are primarily informal discussion groups devoted to special interests. Papers are presented, to be sure, but these papers may not necessarily be the formal reports of extensive research usually presented to the Academy general sessions. All Fellows interested in the subject matter area are invited to participate either in the discussions or in presenting a paper. If you have something to contribute, or if you just wish to listen, you are welcome. You may attend one Section or several. Seldom are the papers or discussions reported in the Archives of the Academy, so to benefit from these meetings it is necessary that you attend in person.

THE SECTION ON CONTACT LENSES AND SUBNORMAL VISION AIDS

Robert Graham, Chairman, Pasadena, California

In recent years the upsurge of interest in contact lenses has been reflected in the activities of this Section. A large and lively group of fellows have regularly attended these discussion sessions. The Section has been called upon to arrange a two-hour symposium on contact lenses for the general session. The Section carries on a certification program and regularly examines and certifies as contact lens specialists those candidates who qualify.

The programs for the coming meeting will be shaped around the following subjects: (a) the accurate determination of corneal topography; (b) bifocal contact lenses; (c) toric, bitoric and perforated contact lenses; (d) current advances in subnormal vision aids; (e) the latest significant developments in the field of contact lenses. Interested Fellows are invited to participate.

THE SECTION ON ANISEIKONIA AND REFRACTIVE PROBLEMS

William P. Schumann, Chairman, Vineland, New Jersey

Aniseikonia is perhaps the specialty in the field of Optometry which demands the greatest exactness in refraction, competence in solving fusional and binocular problems. One of the functions of the Section is to make all Fellows more familiar with aniseikonia and its

problems. Case studies and special applications of eikonometry are of special concern. A current problem in this field is the resulting aniseikonia in monocular aphekia corrected by a contact lens.

All optometrists are concerned with the techniques of measurement and interpretation of refractive problems. This Section is interested in discussing and evaluating both new techniques and new instrumentation, as well as theoretical considerations. It is felt that the sessions on refractive problems are of intense practical importance to every Fellow. These sessions serve, too, as a clearing house for possible answers to grief cases, where the combined thought of the group may suggest solutions overlooked by an individual practitioner.

THE SECTION ON BINOCULAR VISION AND PERCEPTION

Max Schapero, Chairman, Los Angeles, California

This Section is concerned with the sensory, motor, and perceptual aspects of vision, whether it be monocular or binocular. Six sub-committees have been created to specifically work on major areas of concern. They are: (1) Orthoptics and Visual Training; (2) Reading; (3) Pleoptics; (4) Ocular motility; (5) Practice Management; (6) Optical Aids for Binocular Vision.

The aims and goals of this Section are to promote interest and understanding in the fields covered, to analyze and discuss recent developments, to promote and present research work, to encourage the writing and publication of papers, and to assist the profession to promote this field. During the Section meetings papers are presented covering all of the topics within the realm of concern, discussions and forums are held, and plans made to implement the aims of the Section.

Ideas and recommendations that will make the work more effective are always welcome. The Section is especially interested in promoting lively discussions on the topics under consideration.

THE SECTION ON PATHOLOGY

Arthur Shlaifer, Chairman, Philadelphia, Pa.

One of the functions of the Section on Pathology is to facilitate optometric detection of pathology, either ocular or systemic, which may be encountered. The Section encourages papers at its meetings which bring to the attention of the participants the newest developments in ophthalmology, with respect to both theory and instrumentation.

For example, the most recent contributions to our knowledge of glaucoma, its detection and control, are periodically reviewed.

The Section encourages the presentation of any unusual case report which involves pathology. In addition, it has presented and is continuing to present papers on the photography of ocular pathology. It has in its possession selected films pertaining to ocular pathology which it will lend to interested optometrists.

Finally, the Section has served as a forum for the discussion of interprofessional relations, a most important subject at this or any time. Dr. Carel C. Koch usually leads these discussions.

Although many formal papers are presented, the Section encourages informal discussions by participants in the Section meetings. Thus, it is the intention of the Section to have a degree of active participation by optometrists attending the meetings.

THE SECTION ON PUBLIC HEALTH AND OCCUPATIONAL OPTOMETRY

Galen Kintner, Chairman, Linden, Washington

Public Health Optometry is the scientific diagnosis and treatment of the vision needs and status of communities as entities; and includes information necessary for group vision care programs, operation of clinics, industrial and school vision programs, and studies of the visual environment. The general area of concern of this Section is with those aspects of optometry not directly concerned with private clinical practice, but with the vision characteristics and needs of groups.

The activities and concerns of this Section are divided into nine sub-committees: (1) Industrial and/or occupational vision and vision screening, (2) Vision problems of school children and vision screening, (3) Vision problems of transport operation and vision screening, (4) Optometry in group practice, clinics and hospitals, (5) Prepaid vision care programs, (6) Optometry's relations with Public Health programs, (7) Optometry's participation in Civil Defense, (8) Optometric participation in Veterans and Government Health Programs, (9) Visual Environment. It should be obvious that the Academy is interested in the scientific and methodological phases of these problems and not in the political aspects.

Formal and informal papers are presented and grouped according to subject matter. Fellows are invited to submit papers and join in the discussions.

SUMMARY

The meetings of the Sections of the American Academy of Optometry offer a unique opportunity for the Fellows to participate in active discussion, presentations of formal and informal papers, and consultation on a wide range of topics of vital interest to their profession.

Since these discussions are seldom reported in the Archives of the Academy it is necessary to attend in person the Sections of greatest personal interest. All Fellows are urged to attend the Section meetings at the Annual meeting of the Academy and to contribute to the discussions. These meetings will be held at the Drake Hotel, Chicago, December 9-12, 1961.

HENRY B. PETERS

VICE CHAIRMAN
PAPERS AND PROGRAM COMMITTEE
AMERICAN ACADEMY OF OPTOMETRY

TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy.

THE 64TH ANNUAL CONGRESS OF THE A.O.A.

Colorado's vacation playground assisted in establishing a new convention record in every department for the American Optometric Association.

The host City of Denver can take pride that the advance registrations alone surpassed any previous congress attendance. The final count surpassed by several hundred the best previous attendance at any A.O.A. meeting.

Those present were greeted by an extremely well balanced program of education, well planned committee meetings, and extremely vocal and active delegates.

One of the highlights of the convention took place the day before the official opening. A plan-ahead conference was arranged for all day Friday, June 16. The plan-ahead session consisted of a short discussion by Richard Schiller of the purpose of the meeting and the method of following through was presented by the incoming President, Dr. Don Frantz.

An effective presentation was made by Dr. John Sugg and Earle Kuehner of "Optometry's Image 1962." This was an illustrated talk demonstrating the various materials available to all committee chairmen and state associations by the Public Relations Department of the American Optometric Association. The climax of the plan-ahead conference was an inspirational, clever presentation by Dr. Herbert True. Dr. True stressed the importance of the individual in committee work and general organizational work. Various methods to motivate committee plans were effectively outlined.

Dr. Nelson Waldman and Richard Erwin, representing the vocational guidance committee, emphasized the importance of individual participation and state association activities in optometry's recruitment program. The highlight of the afternoon session was a leadership training seminar by Harold Bailey and Dave Sharman of the A.O.A. Staff. Obviously an organization such as the A.O.A. is no more effective than its individual committees. Committee training has of necessity been rather loosely conducted over the years. A participant workbook was supplied to all of the committee chairmen and state association presidents in attendance. The highlights of this committee training kit were stressed in a visual presentation. Such items as what it takes to be a good committee, what makes a productive committee meeting, the principles of effective committee work, and the value of the committee to individuals participating in it were discussed. The twenty committee chairmen of the A.O.A. made a short streamlined report of the activities of their committees. This in itself served as a training session by outlining projects which can be successfully conducted in committee activities. All in all this was an extremely worthwhile day for those in attendance.

The official opening of the congress was given an international flavor by the introduction of a group of Japanese representatives. Through their interpreter it was learned that these men were in America studying the various optometric schools for the purpose of establishing the first professional optometric training course in Japan.

One of the problems over the years has been the lengthy committee reports of the committee chairmen before the A.O.A. Congress. The reports were streamlined this year in a brief outline of each committee's activities by President Schiller. The individual committee chairmen were present to answer any questions which might arise.

Perhaps the most obvious impression of the entire A.O.A. meeting was the wide variety of meetings and activities which were being conducted simultaneously. The American Optometric Foundation, the

International Association of Boards of Examiners, the Association of Schools and Colleges, and the Association of Military Optometrists were among the groups in constant session during the congress.

The Colorado Optometric Extension Program under the direction of Albert A. Sutton, Chairman, were hosts at a dinner honoring the living past-presidents of the American Optometric Association. An extremely effective presentation was made by H. Ward Ewalt, Jr., to the seven Past Presidents in attendance. A short biographical sketch was presented of each man and the major contributions made during their terms of office were stressed. This was followed by the address of the evening, "Fabulous New Frontiers for Optometry," by Richard Schiller.

One of the features of the congress was the well balanced educational meetings which were in constant session. These, of course, were running concurrently with the A.O.A. House of Delegates, so that no one lacked for activity. Dr. Wendell Bryan's Committee on Education had put its stress on orthoptics and visual training, practice management, visual problems of children and youth, and contact lenses. The educational sessions were well attended and well received.

As had been anticipated the resolution concerning optometry's premise created the most fireworks on the floor. After much writing and rewriting of the resolutions it was decided that optometry should continue on its original premise.

The confidence of the delegates in attendance from several states in the A.O.A. and its varied activities was well expressed in the overwhelming vote for the dues increase.

The Fourth Annual Awards Luncheon was featured by presentation of the "Man-Mile Trophy" to the Utah Optometric Association; the "Auxiliary Seals Fund Award" of $1,500.00 for the preparation of a driver's educational manual was given to the Committee on Motorist's Vision of the A.O.A.; the "Operation Manpower Award" was presented to the State of Florida for its contribution in this area; The Universal Optical Company received a presentation by Dr. Richard Schiller for its 50 years of contribution to the vision care professions; Iowa State University received the award for the finest educational programs in vision care in the communications media; George D. Spache received a citation for his work in the reading field; Dr. A. M. Skeffington received an award for his valuable contribution in the postgraduate education area. The presentations were made in an impressive manner before a well attended luncheon audience.

Dr. Don A. Frantz, De Kalb, Illinois, takes over as president of the A.O.A. Dr. H. Ward Ewalt, Pittsburgh, was elected president-elect and Dr. Judd Chapman, Tallahassee, Florida, was elected vice-president. Dr. Richard C. Schiller, Marshalltown, Iowa, will be the immediate past-president on the board along with the following trustees, Dr. Joseph Rowan, Kansas; Dr. Charles Seger, California; Dr. Eugene McCrary, Maryland, and Dr. George Masten of Colorado.

Chicago, Illinois, will be the convention city for 1962.

RALPH E. WICK

CURRENT COMMENTS

Terry Judith Parkins
Editorial Assistant

Optometrists will confer a favor by sending news items of general interest for this department; such as relate to new instruments, clinical techniques, education, visual health and optometric legislation and organization.

THE ROBERT R. McCORMICK CHICAGO BOYS CLUB VISION CLINIC

The Robert R. McCormick Chicago Boys Club located on the Northside of Chicago in the Uptown area, is one of the newest, largest and best equipped Boys Club in the United States. It is a memorial to Col. Robert R. McCormick, the late editor of the CHICAGO TRIBUNE. The doors of the Club have been open for nine months and operation is in full swing. Eventually, the membership will reach three thousand —more than one thousand boys are members at the present time. The Club consists of a great deal more than athletics and swimming facilities. It has many varieties of games, arts, music, a quiet room for study, also a library. The Club offers counseling and many other services.

The Club has a six-chair Dental Clinic operated by the Northwestern University Dental School in conjunction with the Boys Club.

Through the influence of Dr. Glenn H. Moore, Chicago, a member of the Board of Managers, a Vision Clinic has been set up which will be operated as a branch clinic of the Illinois College of Optometry. This is in keeping with the Boys Club policy of having all of its health facilities in connection with the leading educational institutions of the several disciplines. Every member of the Boys Club will be given a full visual examination, including visual skills, each year.

An anonymous donor contributed the necessary funds for a completely new DeLuxe Bausch and Lomb Refracting Unit, with all the necessary impedimenta. A room in the Club building has been given to the Illinois College of Optometry for the operation of this Clinic. Dur-

ing the first year the clinic at the Robert R. McCormick Chicago Boys Club has been under the supervision of the faculty in charge of the College clinic. Faculty members and senior clinic students have been doing the screening and refractions.

For the second year a Post Graduate Residency Grant has now become available to the Illinois College of Optometry to be used for a one year residency at the Robert R. McCormick Boys Club. This was made possible by a public-spirited individual who wishes to remain anonymous. Through the generosity of this man, an annual grant of six thousand dollars has been made available to a new graduate of the Illinois College of Optometry. The recipient of the grant will devote one year to the Vision Clinic at the Robert R. McCormick Boys Club, where he will supply vision care to the boys of the Club. At the end of each year, a new recipient will replace him. The grant will be paid at the rate of $500.00 each month for 12 months.

The residency year will begin on July 1 each year and end June 30 the following year. Applicants for the grant have been devoting one or more afternoons each week and a part of each Saturday understudying at the Boys Club, in preparation for the residency, and will be under the supervision and direction of the optometric resident in charge at that time.

As the Boys Club Vision Clinic is a branch of the Illinois College of Optometry Clinic, the resident will be under the direct supervision of the Director of Clinics at ICO, and will look to the Director of Clinics for instruction and directives as to policy. The winner will be announced following the regular graduation exercises in June of this year.

FRY HONORED AT DEDICATION

On April 16, the new $600,000 addition to the Optometry building at Ohio State University was dedicated. Several hundred optometrists and friends of optometry attended in spite of a severe April storm. The new clinical facilities provided by this building are outstanding with ample space for teaching all phases of optometric practice.

Although the announced program had to do only with the dedication of the building, several events of significance were coupled with the occasion. Dr. Glenn A. Fry, the director of the school, was honored for twenty-five years of outstanding service to the school and the profession. Dr. H. Ward Ewalt presented Dr. Fry with three volumes of letters from friends throughout the United States and from other countries. The writers of these letters thanked and praised Dr. Fry for his

outstanding work in the field of ophthalmic optics and optometry.

At the dedication exercises the announcement was also made of the establishment of the *Glenn A. Fry Fund* under the Ohio State Development Program. A description of the fund follows: This fund is to honor Glenn A. Fry for 25 years of outstanding service as director of the School of Optometry, and for his many contributions to the literature and research in the field of physiological optics and for his leadership in the advancement of optometry and its service to the public. The principal and any additional contributions to be invested in accordance with Section 3335.12, Revised Code—State of Ohio, the income to be used by the director of the School of Optometry for any purpose pertaining to optometric education. Additions to the principal can be made at any time. All optometrists are invited to contribute. For further information write to Dr. Nelson E. Abrahamsen, Sr., 2808 Clark Ave., Cleveland 9, Ohio, Chairman, Honoring Fund Committee.

Another important event at the meeting was the presentation to Dr. and Mrs. Fry of a silver tea and coffee service on behalf of their many friends on the campus and in Ohio. This presentation was made by Dr. Harold Oyster, one of the local optometric leaders and a member of the Ohio State Legislature. Other speakers at the meeting were Dr. John Zettel, president of the Ohio State Optometric Association: Dr. Donald A. Frantz, president elect of the A.O.A., and Dr. Grant L. Stahly of the University.

STEWART HEADS RESEARCH FOR CONTOUR

Dr. Charles R. Stewart, former dean of the University of Houston College of Optometry, has been appointed director of education and research for Contour Comfort Contact Lens Company of Waco, Texas, effective July 1. In his new position, Dr. Stewart will supplement present educational and consulting services of the firm. He also will direct a program of research and development.

Contour Comfort was founded by Dr. Irving Brodsky and Dr. Herman H. Gerdes, Jr., in 1959, and has experienced steady growth and recognition in the field. Its lenses and other manufactured products are distributed throughout the United States and Mexico.

"We are proud to broaden our services to the profession through the educational activities to be carried out by Dr. Stewart," said Dr. Gerdes, president of the company. "Our goal has always been to contribute to the advancement of the contact lens field and Dr. Stewart's appointment is in keeping with this policy."

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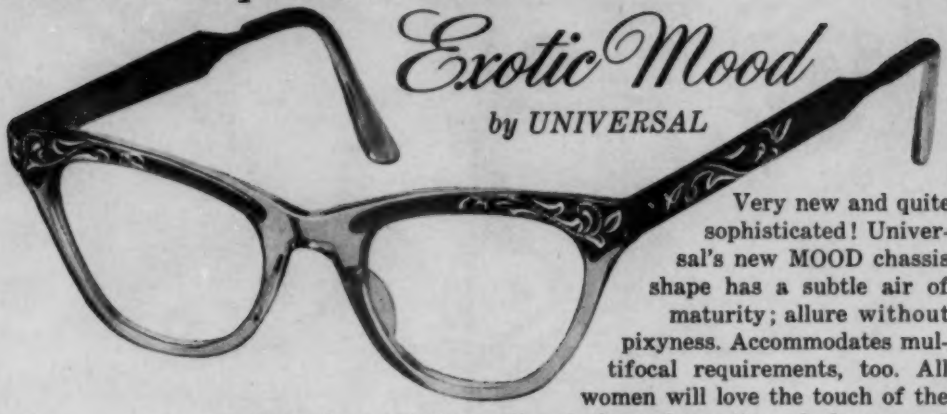

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SYNOPSIS of GLAUCOMA for OPTOMETRISTS

Arthur D. Shlaifer
O.D., Ph.D., F.A.A.O.
Pennsylvania State College of Optometry

Reviewers say:

"This book is must reading and could well be used as a standard text in our optometric schools and colleges.

". . . the book is written in straightforward, easy to read English . . ."

ELMER S. FRIEDBERG, O.D., F.A.A.O.
Journal of the American Optometric Association

"This book fills a long felt need in optometry. The phenomenal sale of this volume indicates that thousands of other optometrists will equally benefit by owning and using it regularly. The book should be read and then kept in full view in the refracting room where its presence on the desk of the optometrist will do much to assure patients who are apprehensive regarding this pathology.

CAREL C. KOCH
Secretary F.A.A.O.
American Journal of Optometry

Contents • anatomical and physiological considerations • symptoms and clinical picture • ophthalmoscopy • gonioscopy the intraocular pressure • tonometry visual fields • etiology • the treatment of glaucoma • pathology • miscellany • a summary of optometric tests for the detection of glaucoma

Usable for both the practicing optometrist and in the classroom, this book is the first in a series of home study courses, published by the American Academy of Optometry, intended to round out its work in postgraduate education. The author is a practitioner as well as an educator. His work covers etiology, clinical signs, symptoms and screening tests used to facilitate the understanding of glaucoma detection and referral.

The subject matter is designed to present the noticeable features of glaucoma to facilitate detection by the optometrist, and subsequent referral to an ophthalmologist.

In addition to this information, all aspects of the disease are covered so that the optometrist will be familiar with procedures used by the ophthalmologist in treating cases which he has referred.

Now in its second printing, Synopsis of Glaucoma for Optometrists is being used in a number of postgraduate study courses. Optical distributors and manufacturers of ophthalmic supplies throughout the country have been successfully selling the book.

It treats the subject matter authentically, briefly, yet completely, according to the American Academy of Optometry requirements.

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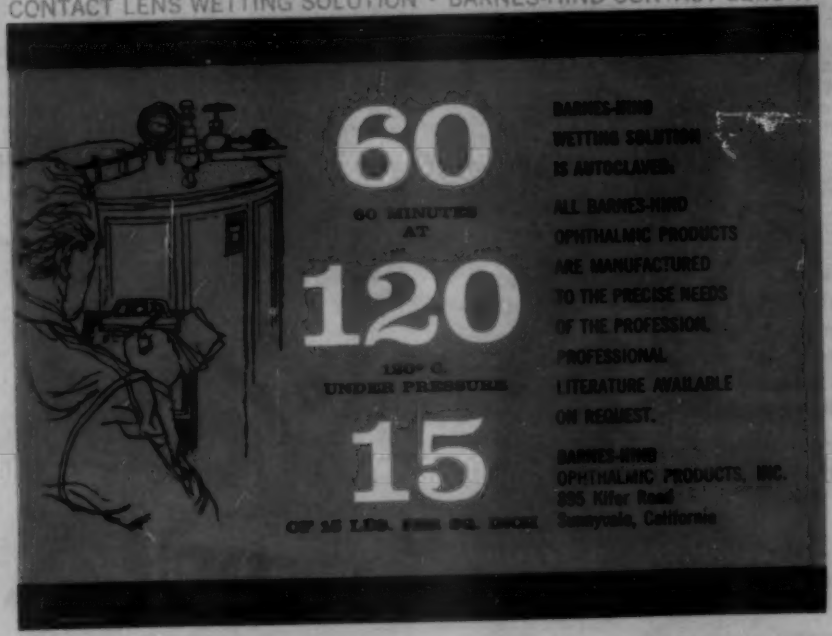
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